MACHINERY

VOLUME 58 **FEBRUARY, 1952** NUMBER 6

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

MACHINE AND TOOL DESIGN

MANAGEMENT PROBLEMS

DEPARTMENTS

By LORING F. OVERMAN

Further Steps Taken to Encourage Machine Tool Production

AS '51 merged into '52, defense began to take on an uncomfortable importance in this country. Official Washington seemed to have conceded defense first place in economic planning with civilian economy a very poor second. All talk of defense production requiring on'y 20 per cent of the available production was forgotten. It was announced officially that, beginning with the first quarter, military or defense-supporting industries would require 40 per cent of all carbon steel and 60 per cent of the country's aluminum and copper-brass mill products.

Hardly had that announcement been made—in mid-December—when NPA publicized the results of a later six-quarter projection reaching into mid-1953. This projection started rumors of "death sentences" for manufacturers of less essential items requiring metals. "The lag in defense procurement," it was explained, "has pushed back the peak in military 'take' of material till some time in 1953. The consequent shifting of procurement schedules means a bigger 'take' of steel, copper, and aluminum than had been originally contemplated."

COUPLED with the forecasts of larger military requirements are decisions to boost steel capacity to 120,000,000 tons; to step up aluminum production; and to devote other "production" metals to the erection of facilities needed to increase the output of minerals, coal, and petroleum products. In other words, much of the metal left over from producing military items is to be used to construct facilities to produce other military items. It is not a healthy outlook for "business as usual."

In any event, the outlook is not at all bright for the "less essential" industries. Those who produce machinery, machine tools, and all the related equipment considered vital to the defense program need not be greatly disturbed about problems of supply. They have no reason, though, to be complacent over their increasingly controlled existence or the drift toward an economy that is dependent upon continued production of war material.

AMONG recent steps taken to place the machine tool industry in line with defense thinking in Washington is the creation of a new CMP program symbol Z-2 giving machine tool production the same urgency status as the A, B, C, and E symbols identifying programs of the defense department and the Atomic Energy Commission.

The new symbols will facilitate production of the fo'lowing equipment: Machine tools, except those that are rebuilt; metal-working presses, except forging; other metal-working machines; jigs, fixtures, punches, dies, die sets, and sub-presses; gages and precision measuring tools; metal-working equipment attachments and accessories.

At a recent conference with business magazine editors, members of the defense production agency conceded that rating machine tools along with guns and atoms bombs represented only one step in the right direction. Many others, they admitted, are involved in moving a machine tool from blueprint to the shaping of a jet engine. The first—and one that has been responsible for a nine months' delay in getting the machine tool program started after the first shot was fired in Korea—is the decision as to which jet engines (or other war material) to produce. Then follow contracts, sub-contracts, facilities problems, the lowering of certificate-of-necessity bars, price adjustments, and all the other steps intended to smooth the path to production.

THE present stumbling block is manpower. Before Korea, some 38,000 to 40,000 people were employed in the machine tool industry. By the end of 1951, employment had risen to approximate'y 65,000. The NPA has been informed that between 18,000 and 25,000 more workers are needed to man existing facilities and those nearing completion.

Some large tool plants are reporting to NPA that they cannot get enough skilled workers to fully man a first shift, and that the only answer is to run shifts from fifty to fifty-five hours with present employes. Sub-contracting, it was reported, had been done by the producers of printing presses, typesetting machines, and machinery used in the container and textile fields. Between 15 and 18 per cent of present defense work is being done by sub-contractors. By the middle of 1952, it is expected that this proportion will increase to between 30 and 35 per cent. Such a total is somewhat higher than that reached during World War II. NPA has announced that its goal is to build up machine tool production to a rate of one and a half billion dollars a year by July 1.

CAPEHART Adjustment Authorized—Machine tool makers have been given the option of applying for Capehart price adjustments under SR 4 to CPR 30, the general machinery manufacturers' order, but if they do so they must forego the provisions of revised SR2 to CPR 30, which entitled them to a September 10, 1951, cut-off date for cost increases, and to a 12 per cent boost in base period prices.

Revision 1 to SR 2 was drafted after the machine tool industry protested that price controls were holding up production of tools needed in the mobilization program. The industy rejected an OPS general overriding order that guaranteed a minimum level of earnings to producers, and the price agency then issued the revised SR 2, granting the September 10 cut-off date, in contrast to a March 15 cut-off date for other machinery makers, and the 12 per cent increase in base period prices to compensate for a "depressed" base period.


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What are You Doing to Ease Scrap Shortage?

SHORTAGE of ferrous and non-ferrous scrap continues to be one of the serious problems confronting those responsible for producing the raw materials of the metal-working industries. Record-breaking steel production has brought scrap inventories of our steel mills to a dangerously low level. Some plants, for example, are operating with less than ten days' supply of scrap, whereas a six- to eight-week reserve is desirable. Fully as critical is the situation regarding non-ferrous scrap. Copper, bronze, brass, aluminum, lead, and zinc scrap are urgently needed in quantities far in excess of what is being received. Unless herculean efforts to collect scrap for the nation's steel mills and foundries are made now, it is certain that the production of military supplies and civilian goods will suffer.

The importance of scrap may be realized from the fact that open-hearth furnaces are charged with approximately 50 per cent scrap and 50 per cent pig iron to obtain maximum production efficiency. Over 80 per cent of the scrap consumed by the steel industry goes into open-hearth furnaces, which produce about 90 per cent of the industry's total output of steel. Thus, with a steel expansion program calling for a production this year approaching 118,000,000 ingot tons of steel, it is clear that scrap is of critical importance.

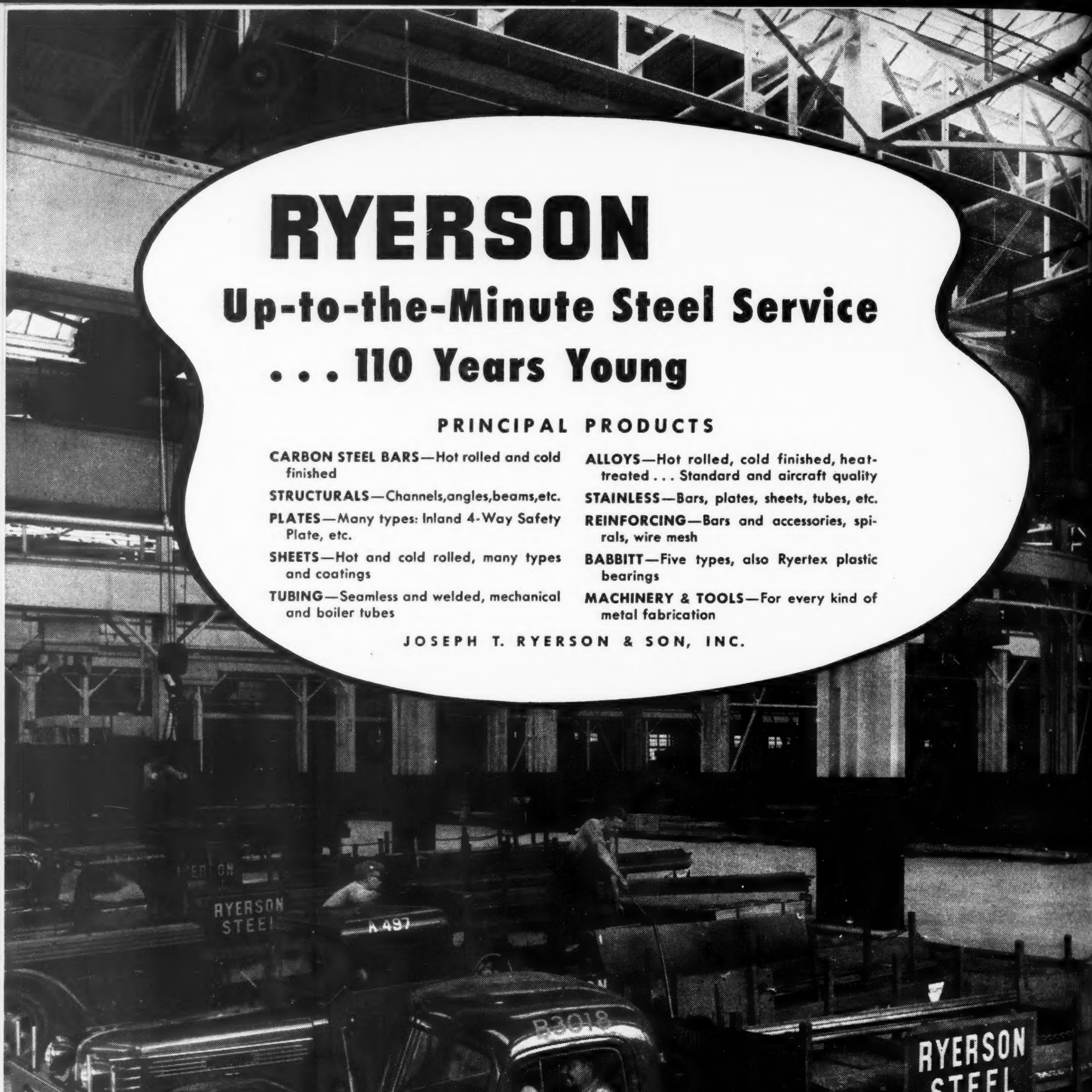
The Government is making every effort to increase the scrap supply by combing the battlefields in the Far East and in Europe, and by organizing intensified programs within the various Federal departments, agencies, bureaus, and services to recover dormant scrap.

However, quick action on the part of both small and large manufacturing plants is essential to a satisfactory solution of this serious scrap problem. In storage departments and in the remote corners of practically every plant, there are obsolete machines. Now is the time to write such equipment off inventories. Nearly every shop also has tools, jigs, dies, and fixtures that are obsolete, broken, worn beyond repair, or abandoned. It is this kind of scrap, which does not flow to the mills as readily as production scrap such as chips, punchings, and trimmings, that is needed so badly today. Some concerns that have made a serious effort to find scrap in their plants have succeeded in collecting several thousand tons.

For every ton of scrap used in steel production, we conserve approximately 2 tons of iron ore, 1 ton of coal, nearly 1 ton of limestone, and other materials. Therefore, each ton of scrap uncovered and sent to the mills and foundries saves precious ore and thus conserves our national resources of iron or copper.

Every shop and factory must institute a real drive to put scrap where it belongs—in our steel mills and foundries—if our defense and civilian manufacturing programs are to be carried out successfully. In so doing, they will also be helping to get raw materials into their own plants.

Charles O. Herb
EDITOR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Machining Graphite in an Atomic Energy Plant

By
J. M. CASE
Maintenance Shop Superintendent
and
R. E. DEW
Supervisor of Graphite Machining
Carbide and Carbon Chemicals Co.
Y-12 Plant, Oak Ridge, Tenn.

FOR many years graphite has found application in industry as electrodes, as a structural material, and as a refractory material. With the advent of atomic research, the application of graphite has extended to moderators and reflectors in nuclear reactors.

Precision machining and minimum waste are demanded where graphite is used in atomic research, a demand that has resulted in considerable research with regard to graphite machining methods. Both experimental and production work in graphite machining for contractors under the Atomic Energy Commission are being done by Carbide and Carbon Chemicals Co., a Division of Union Carbide and Carbon Corporation, in connection with the Atomic Energy Commission's program at Oak Ridge, Tenn. This

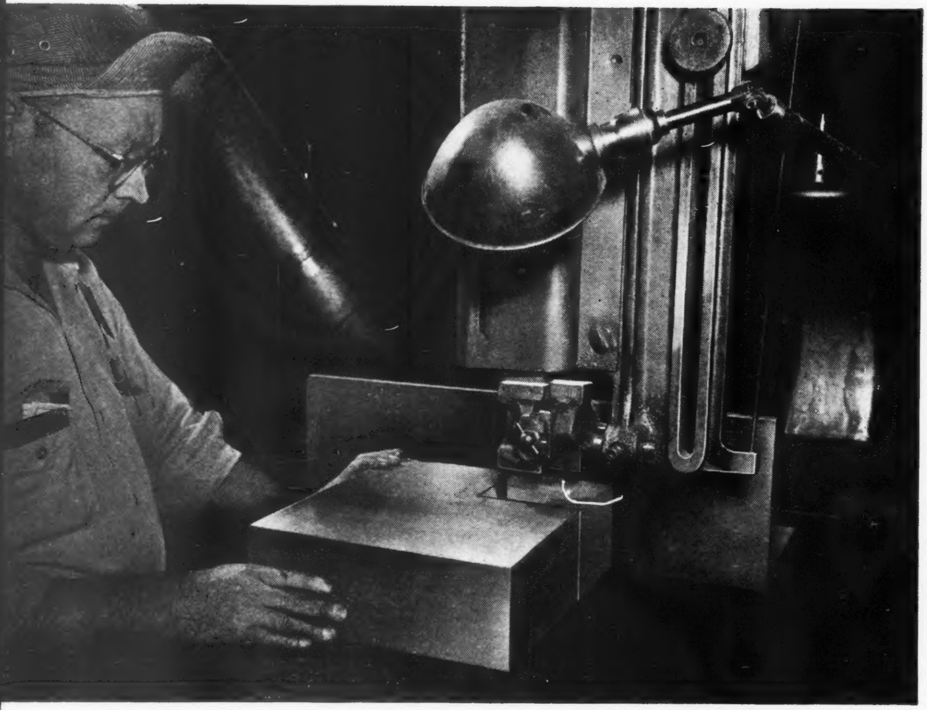


Fig. 1. Cutting a large block of graphite into smaller sections by using a woodworking band saw

article will describe some of the graphite machining practices employed, many of which are at variance with normal machining procedures.

Woodworking tools are used in roughing operations, but carbide-tipped tools are employed for precision finishing. A woodworking band saw is used for slitting bulk stock into rough slabs, as shown in Fig. 1. Before cutting, the piece is inspected to find a flat surface that can be placed against the cutting guide, which is twice as long as the piece being cut. A 3- to 6-pitch DoAll saw blade is used at a speed of 200 to 690 feet per minute, depending upon the type and size of the piece being cut.

A woodworking planer is used occasionally for removing excess stock prior to grinding, but in the majority of cases, sawing alone produces sufficiently accurate blocks. In using the planer,

Fig. 2. Feeding a block of graphite through a wood planer for rough-machining large flat surfaces

Fig. 3. Placing a vacuum chuck on the magnetic chuck of a surface grinder for handling graphite pieces

certain modifications were necessary; for example, the bedplate and lower rollers were removed and replaced by a continuous steel bedplate. This change helps to keep the material level as it passes under the cutter. Also, the metal upper rollers were covered with rubber washers to prevent chipping the surface of the material.

Even with these modifications, the woodworking planer cannot be used for removing any twists and bows in raw blocks. Since pressure is applied on this machine only as the piece passes under the cutting blades, a long bow or twist would be repeated rather than removed. Therefore, the material is usually taken directly from the sawing operation to a primary sizing operation, performed on either standard surface grinding or milling machines. In Fig. 2, a Delta-Crescent wood planer is shown being used for shaping graphite blocks to size within a thickness tolerance of 0.002 inch on cuts as deep as 7/8 inch.

Since graphite is non-magnetic, the usual magnetic chucking method would be cumbersome because it would necessitate blocking of the

Fig. 4. Finishing flat blocks of graphite on a small surface grinder equipped with a vacuum chuck

graphite slabs with steel parallels. On the large surface grinder used in the sizing operation, the magnetic chuck has been replaced by a fixed vacuum chuck. This chuck consists of a hollow steel block with holes through the top plate. Suction is applied by a vacuum system, which can be used by several machines at one time. The vacuum chuck is particularly valuable for grinding thin slabs upon which it is difficult to place steel parallels.

Fig. 3 shows the operator mounting a vacuum chuck on the regular magnetic table of the machine, while Fig. 4 shows an operation being performed on graphite blocks that completely cover the surface of the vacuum chuck. When the work does not cover the entire chuck, thin plates of steel, slabs of graphite, or other material may be used to cover the holes not required to hold the work, as illustrated in Fig. 5.

The vacuum chuck is, of course, limited to applications where the work-pieces have a flat uninterrupted surface that can be acted upon by the vacuum; for parts in which holes have been machined, the magnetic chuck is often needed. It is therefore inadvisable to attach the vacuum chuck permanently on all surface grinding machines. Consequently, several vacuum chucks have been constructed to be held in place by the magnetic chuck, so that either chucking method can be conveniently used.

As the graphite blocks come from the sawing operation, grinding of large surfaces is done on a vertical surface grinder equipped with a vacuum chuck and automatic table feed. A segmental abrasive wheel is used. Careful control of the table feed and the wheel speed must be maintained to insure a smooth surface. In grinding to a fine finish on graphite, about 0.010 inch of stock may be removed at one pass, using a feeding rate of 0.005 to 0.02 inch per wheel revolution and maintaining a tolerance of plus or minus 0.001 inch.

The grinding wheel is dressed in a manner peculiar to the Oak Ridge shop. The wheel used originally had a cutting surface 2 inches wide. At speeds and feeds selected for good surface finishes, enough heat was generated in the graphite to distort the chuck. To stop the excessive heating and continue operating at efficient speeds, the cutting surface of the wheel was reduced to a width of 1/4 inch. After dressing the wheel square, a 45-degree cut is taken on the entire inside circumference of the rim, leaving the 1/4-inch cutting surface on the outside of the wheel.

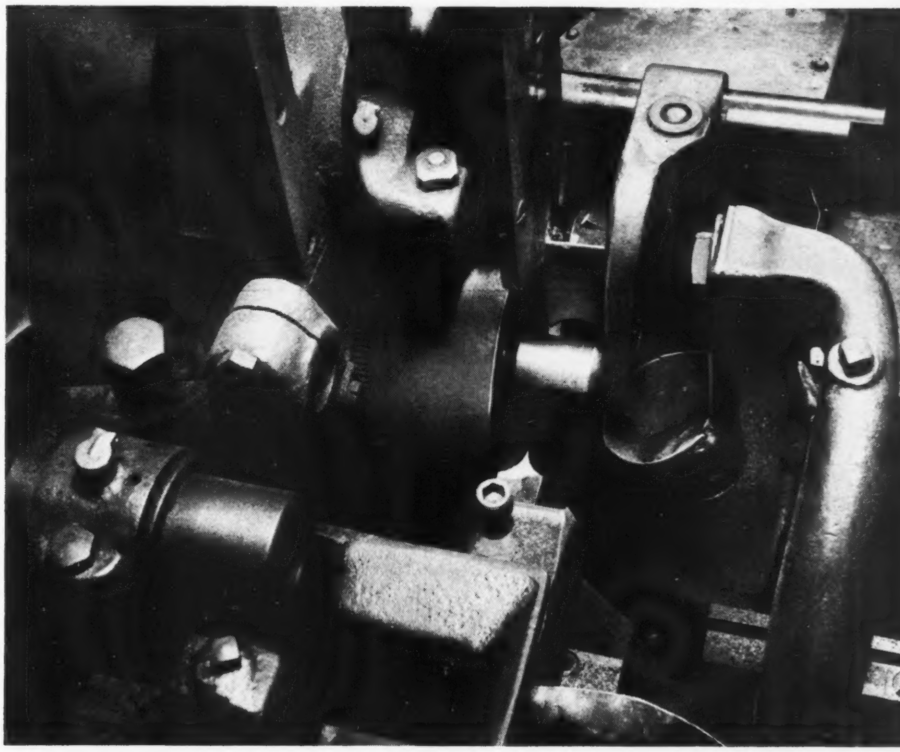
Two sides of the graphite block are ground parallel to each other, and one of the other sides is then squared. As in most squaring operations, a 90-degree angle-plate is used. The plate is clamped to a vacuum chuck or placed on a magnetic chuck, depending upon the machine used for grinding. The graphite block is then clamped to the angle-plate in such a way that a small amount of stock extends above the plate. The required amount of stock is ground off by using regular grinding techniques. Squaring completes the primary operations. The stock has now been cut to the outside dimensions of the work and is ready to be machined to final form.

The final forming is accomplished on milling machines when the part to be made is not cylindrical. Many of the parts are basically boxes, with various contours, slits, or holes machined in them, or flat parts intricately designed. In milling such parts, tolerances range from plus or minus 0.001 inch to plus or minus 0.005 inch.

Duplicating or tracing is done on milling machines equipped with moving tables which follow a template. If a large amount of stock is to be removed, the piece is rough-cut on a band saw

Fig. 5. When the blocks of graphite to be ground do not cover the entire vacuum chuck, steel plates are placed over the exposed holes of the vacuum chuck

Fig. 6. Automatic screw machine employed for turning graphite balls from cylindrical stock



and finished on a milling machine. When large faces having a width of 3 inches or more are to be machined, an extra long end-mill is used. Light cuts, ranging from 0.020 to 0.030 inch, are taken at a spindle speed of about 1400 R.P.M. This procedure results in a good finish and high accuracy.

Slits and holes are cut on a vertical milling machine, spindle speeds and table feeds being selected according to the size of the tool and the depth of the cut. A slit 1/4 inch long by 1/4 inch wide can be cut satisfactorily with a spindle speed of 1000 R.P.M. and a table feed of 16 inches per minute. On deeper, wider cuts, the table feed and spindle speed are considerably reduced. For example, a slit 1 1/2 inches deep by 1 1/2 inches wide would be cut at a spindle speed of 300 R.P.M. and a table feed of 3 1/2 inches per minute. Deep, narrow cuts must be taken even more slowly to prevent breaking the tool. The heading illustration shows a Bridgeport turret milling machine being used for cutting semicircular grooves in graphite parts with a special fly cutter.

In machining graphite, the usual high-speed steel drills and cutters are used. However, because of the presence of abrasive ash (approximately 0.25 per cent), cutter wear may be high. A dull cutter causes chipping and shearing, so that if tolerances are to be maintained, a close check must be kept on cutter wear and tools must be reground frequently.

As a matter of fact, cutter wear is probably one of the most serious problems in machining graphite. Even carbide-tipped cutters have a comparatively short life. An economical solution to the problem was found in the development of fly cutters made from used high-speed steel saw blades. Cutters of this type are made in the toolroom of the shop, and since they are constructed from used blades, the costs involved in their fabrication and maintenance are minimized. The cutters are easily constructed in various sizes and shapes, and are readily ground.

In addition to having the advantages of low cost and easy grinding, the fly cutter is especially adaptable to graphite work. One of the limiting factors to the speed at which graphite can be machined is the temperature of the tool. External coolants cannot be used on graphite, since the coolant will form an abrasive paste with the graphite dust. The fly cutter is adequately cooled by the air surrounding it, and thus may be used at higher speeds than, for example, a drill.

Fly cutters are regularly made for machining holes from 1/2 inch to 10 inches in diameter. In special cases, holes of even larger diameter have been machined with cutters of this type. Where it is desirable to cut compound curves on the external surfaces of parts, the fly cutter is also suitable.

One of the most interesting machining operations consists of making graphite balls on an automatic screw machine, as illustrated in Figs. 6 to 9, inclusive. In Fig. 6, the cylindrical bar of graphite has just been fed to the automatic stop; in Fig. 7, a narrow-blade type of cutter is seen machining the major portion of the ball; and in Fig. 8, the narrow blade, having com-

Fig. 7. A thin blade mounted on an overhead slide machines the major portion of the graphite ball on an automatic screw machine

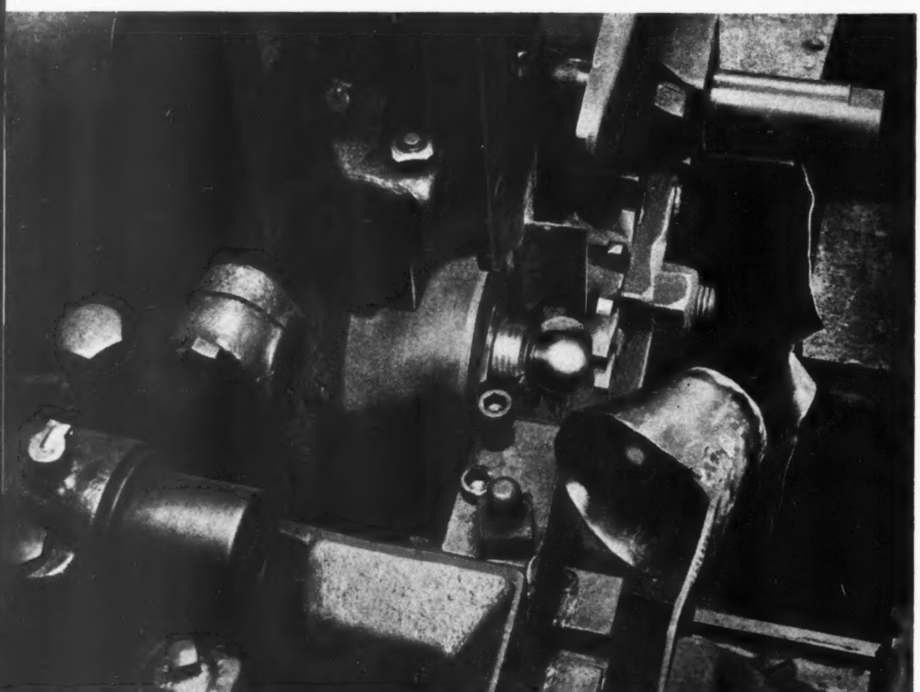


Fig. 8. After the major portion of the graphite ball has been machined, a cutting edge on a multiple tool at the rear rounds the front or projecting end of the ball while a parting tool on the front slide finishes the rear end

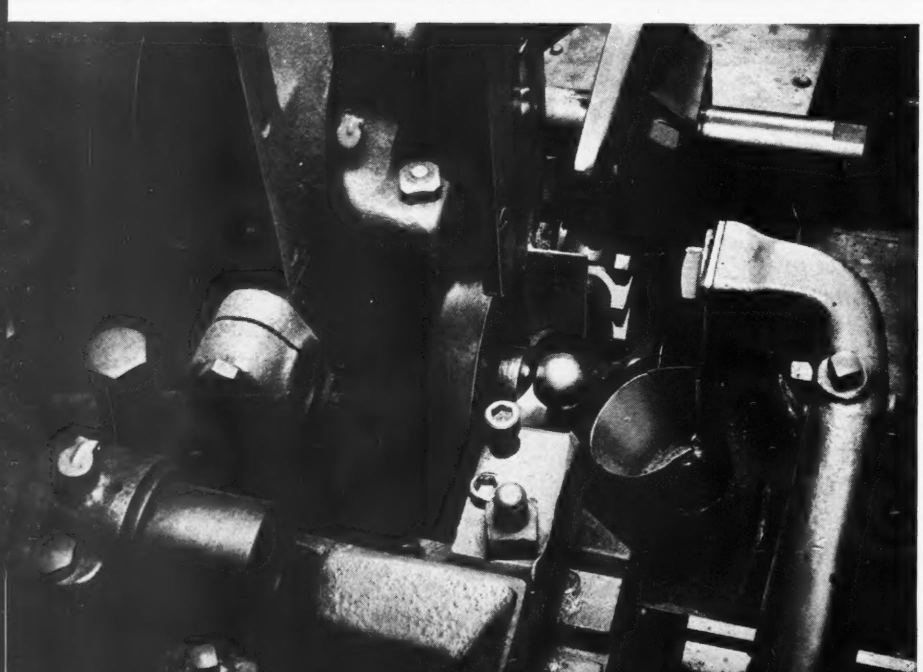


Fig. 9. As the operation on the graphite ball nears completion, the upper and rear tools of the automatic screw machine are withdrawn from the work while the parting tool finishes its stroke

pleted its work, has been withdrawn by the overhead slide on which it is mounted, and one of the cutting edges on a multiple-tooth tool at the back rounds the front or projecting end of the ball while a parting tool on the front slide rounds the rear portion of the ball and cuts it from the bar; in Fig. 9, the parting tool is seen nearing the end of its cut.

When the ball is cut off, it falls into a bucket attached to a swinging arm. The bucket is then swung upward, as shown in Figs. 7 and 8, to permit the ball to drop into a chute which leads to a container. The multiple-tooth cutter does not revolve, the extra teeth being provided for the purpose of quickly indexing a sharp cutting edge into place when one becomes dull.

The grinding of tools for graphite work, as for metal work, is of prime importance. Since graphite has little cutting resistance, it is possible to grind more clearance on cutters used for machining graphite than on those employed for cutting steel. In fact, it is advantageous to grind enough clearance to allow maximum space for chips on cutters that are to be used on graphite. This practice not only increases the life of the cutter, but also speeds up operations. In drilling, for example, it reduces the number of times that it is necessary to remove dust from the holes being drilled.

All machines in the Oak Ridge shop are equipped with a 4-inch flexible hose, attached to an exhaust dust collector having a capacity of 5000 cubic feet per minute. The exhaust hose is placed close to the work, so that most of the dust is withdrawn from the operation. In cutting holes, the fly cutter does not block the entrance to the hole, which reduces the possibility of binding of the tool. More important, however, the operator can drill a fairly deep hole without contending with the normal problems of dust removal.

The Oak Ridge carbon shop in which these operations are performed is an experimental as well as a production shop, as previously mentioned. Molds, drying boxes, heater parts, containers, threaded pipes, spiral powder feeders, springs, nuts, washers, and standard parts for the calutron isotope separation equipment, as well as entire graphite assemblies for nuclear reactors, have been fabricated by this shop. The successful manufacture of such a variety of parts is dependent upon many factors. These include a well equipped shop, experienced personnel, and ingenuity in planning.

New Method of Determining Endurance Limit of Steel and Other Materials

A RAPID and accurate way of testing steel alloys and other metals and plastics to find out how long they will stand up under normal loads when used for making moving parts of machines has been developed at the Rensselaer Polytechnic Institute. The apparatus makes it possible to complete a test in ten hours or less, whereas by former methods, the same job required three months or longer on costly machines under expert supervision.

The new development, called the Dilastrain method, is based on precise measurements of the extent to which specimens of a given material will expand under controlled temperatures. The patent rights will be held by Rensselaer Polytechnic Institute, which will make the Dilastrain method available under a licensing plan.

In using this method, identical specimens of a material are selected and subjected to stress within a definite range. They are then put through an equal number of cycles of vibration, so that all will be on an even level of fatigue. This takes a few hours. Next the specimens are placed in the apparatus and subjected to controlled temperatures ranging from 20 degrees C. (ordinary room heat) to 100 degrees C. (the boiling point of water). All test pieces have the same length—about 2 inches—to start with, but it has been found that as temperatures are stepped up, each changes in length in proportion to the amount of stress to which it has been previously subjected.

The apparatus automatically magnifies the amount of each expansion 3500 times and records it. In approximately two hours, the total linear expansion of all test specimens has been recorded. When these values are plotted against the stresses previously applied to the specimens, a sharp dip in the resulting curve appears at the point where the test material reaches its endurance limit.

Tests have been made on a chemically complex steel alloy supplied by the Allegheny Ludlum Steel Corporation, and the endurance limit determined by the method described in the foregoing, is said to be more accurate than that found by ordinary methods.

Arsenal Methods of Machining

EACH successive conflict in which the United States has been engaged has produced new types of weapons which have been instrumental in attaining ultimate victory. Previous to our entry into World War II, various sizes of anti-aircraft guns were given much publicity, among them the 90-millimeter cannon. This gun became so popular that it is standard on many medium tanks now in mass production. As an independent item of mobile firepower, it serves not only as an anti-aircraft weapon, but also, in the modified version here described, as a very effective anti-tank gun.

It is representative of the finest in cannon engineering, and is truly a precision instrument built on a large scale. This gun is a long-range weapon, capable of delivering a knock-out blow to heavily armored tanks, and its manufacture requires the highest skills available from men and machines.

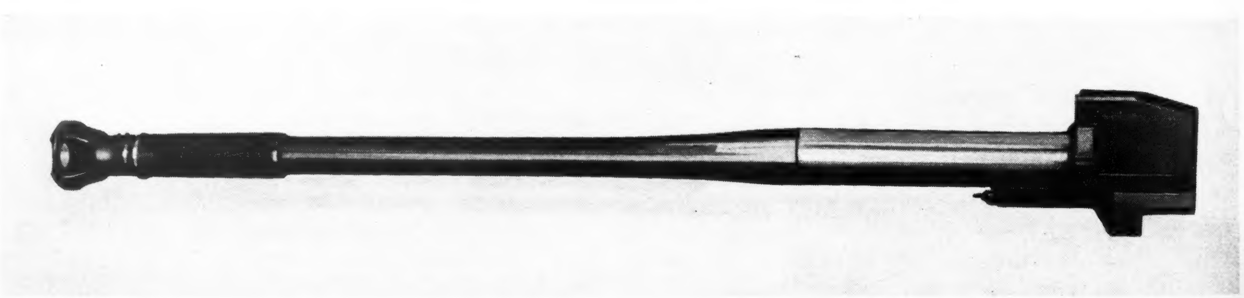
Production of the 90-millimeter cannon is accomplished generally through separate manufacture of the gun mount and the barrel or "tube." The various machining treatments given are numerous enough to warrant separate descriptions of both tube and mount manufacture, but in this article, only the gun barrel operations, as conducted by the Watervliet Arsenal, will be considered.

The entire manufacturing process involves about thirty-five operations between the time the raw material, in the form of a rough forging, is received until the barrel is completely finished. As shipped by the mill, the modified S A E 4340 steel forging is about 15 feet long, weighs more than 1500 pounds, and is rough turned and bored when received at the Arsenal.

The machining operations are divided into nine major groups as follows: (1) Preliminary machining; (2) rough exterior turning; (3) reaming; (4) honing; (5) machining powder chamber; (6) machining breech end; (7) finish exterior turning; (8) rifling; and (9) machining muzzle end. The steps will now be described.

Preliminary Machining

Absolute straightness of the finished bore and concentricity of the tube are the most important objectives in machining the gun barrel. Through preliminary machining sufficient information is obtained to permit the extremely accurate subsequent machine set-up necessary to assure this precision. First operations consist of rough-



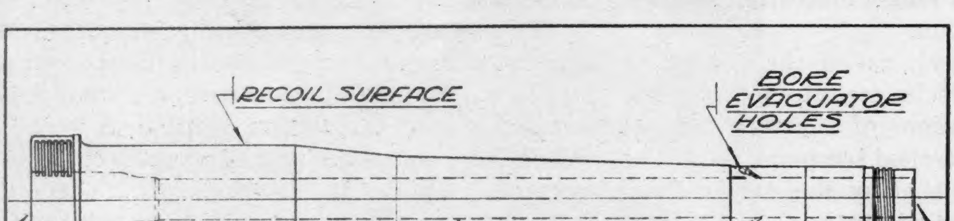


Fig. 1. (Above) Finished 90-millimeter gun barrel complete with breech-ring, muzzle brake, and bore evacuators

Fig. 2. Diagram of gun barrel, indicating various surfaces machined with equipment referred to in this article

90-Millimeter Gun Barrels

facing the ends of the forging and turning a short section on each end concentric with the barrel bore.

The piece is then placed on rollers to permit rotation, and indicator readings are taken within the bore. These readings determine the amount of run-out of the bore and the stock distribution around it. The operation is called "telltaling," and the data compiled from it permits accurate location and machining of steadyrest spots.

Rough Exterior Machining

Exterior surfaces of the tube are given a rough machining after the "telltaling" is completed. The objective is to remove metal as rapidly as possible. Some idea of how rough this operation is may be gathered from the fact that approximately 1/2 inch of stock is removed in two passes. Carbide tools are used, and the operation is performed without the use of coolants, despite the heat generated by such a heavy cut. The tube is checked for run-out, and if distortion has occurred, the work is straightened in a hydraulic press.

Reaming Operations

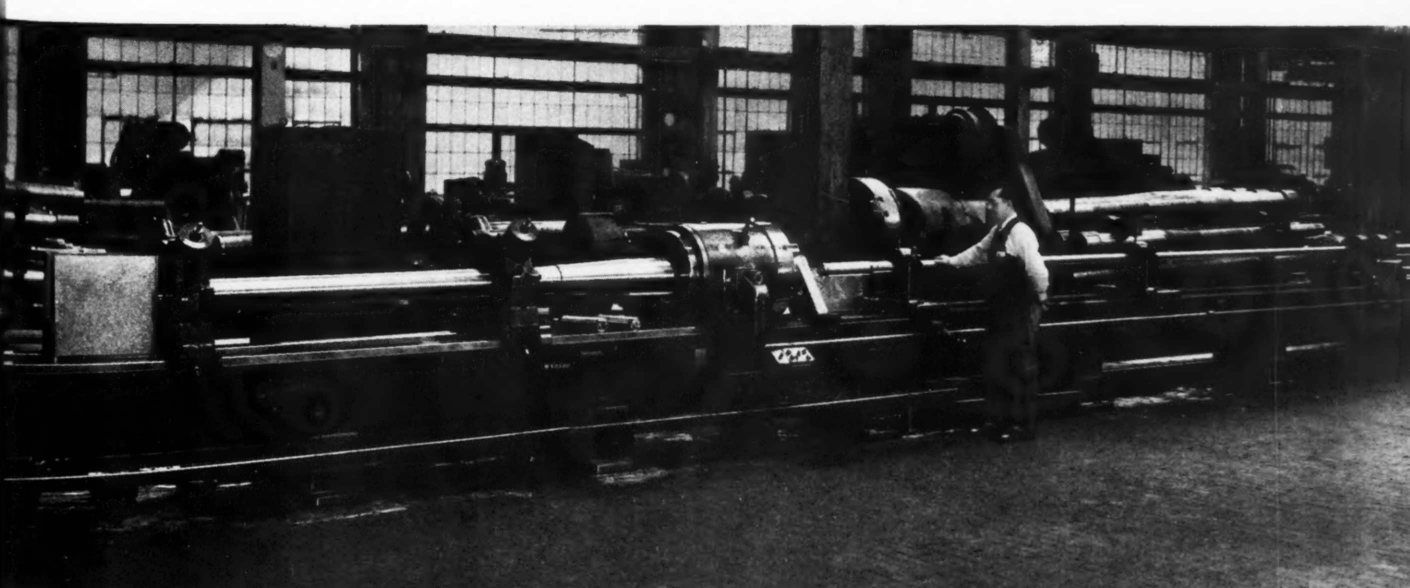
The reaming of the tube is done on a LeBlond hollow-spindle, single-end boring lathe set up as shown in Fig. 3. Two-blade, carbide-tipped, babbitt-packed reamers of the type illustrated in Fig. 4 are used for this operation. The reamers are so ground as to produce short chips, small enough to be carried away readily by the coolant, which is Houghton "Antisep All-Purpose Base," mixed in the proportion of 1 to 20 with water. Chip accumulation would destroy the reamer—hence the importance of keeping chips small enough to be easily washed away.

Three roughing passes are made through the bore, approximately 13/64 inch of stock being removed at each pass, while about 1/64 inch is left for finishing. Here, again, the coolant plays an important part, for the body heat of the reamer must be kept at a minimum. Expansion of the tool could result in an excessive removal of stock, either ruining the barrel or leaving insufficient metal for proper finishing. The boring supplies the straightness, while the subsequent honing gives the final size and finish. Reaming is done with a feed of 0.10 inch per revolution and a speed of 110 surface feet per minute.

Honing to Final Size and Straightness

The rough-honing of the bore follows the reaming operation. This is done by a set of twelve vitrified bond honing stones of 150 grit in a horizontal honing machine having a 25-foot stroke. The coolant used is Houghton's MM honing oil. At the end of the honing operation, the

Fig. 3. Boring lathe set up for performing reaming operations on the breech end of 90-millimeter gun barrels



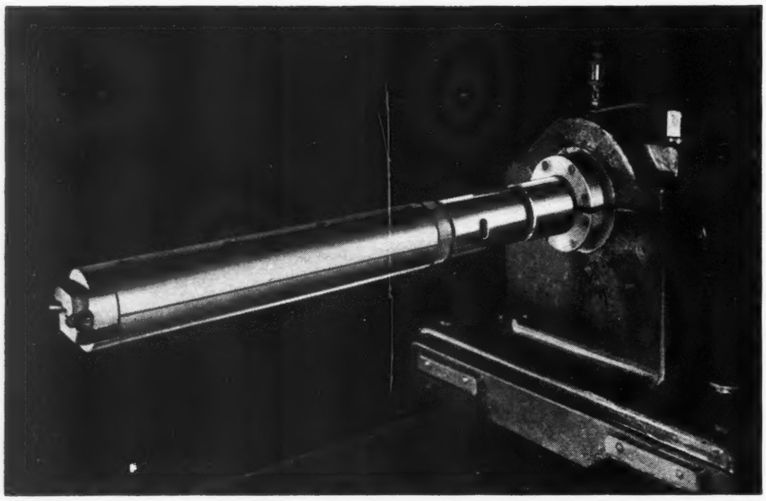


Fig. 4. Close-up view of a babbitt-packed reamer showing the carbide-tipped blades. This tool is attached to the boring-bar by means of a bayonet shank which permits it to float

bore is within a few thousandths inch of the finished size, and the concentricity is sufficient for accurately locating the powder chamber. Further honing, using 350-grit stones, is done immediately before rifling and after all outside turning is finished. This brings the bore to finished size and required straightness.

Machining Powder Chamber and Breech End of Tube

When the precise location of the powder chamber has been determined after the rough-honing, the actual machining operation on the chamber involves two steps—roughing and finishing. In the first step, a modified Warner & Swasey turret lathe (Fig. 5) is employed, utilizing three stations of the turret. At the first two stations the tapered sections of the chamber are roughed out. At the third station, where a carbide-tipped tool is guided by an overhead cam, the approximate contour of the chamber is roughed out. This involves heavy removal of stock, and the same coolant is used as in the reaming operation, but in the proportion of 1 to 30.

The second step, or finishing operation, is done on the Bryant internal grinder illustrated in Fig. 6. Chamber contour is developed by a cam-controlled internal grinding wheel, approximately 0.010 inch of stock being removed in a series of passes by an aluminum-oxide vitrified abrasive wheel. As stock removal and surface finish are important elements to be watched, particular attention is paid to both wheel and coolant. The same coolant base as employed in reaming and rough-machining, in a 1 to 70 dilution, is used for this operation. The surface finish produced by the grinding operation is 16 micro-inches r.m.s.

The most important operation in finishing the

Fig. 5. Rough-boring the powder chamber on a turret lathe, the boring tool being guided by a cam to form the desired internal contour

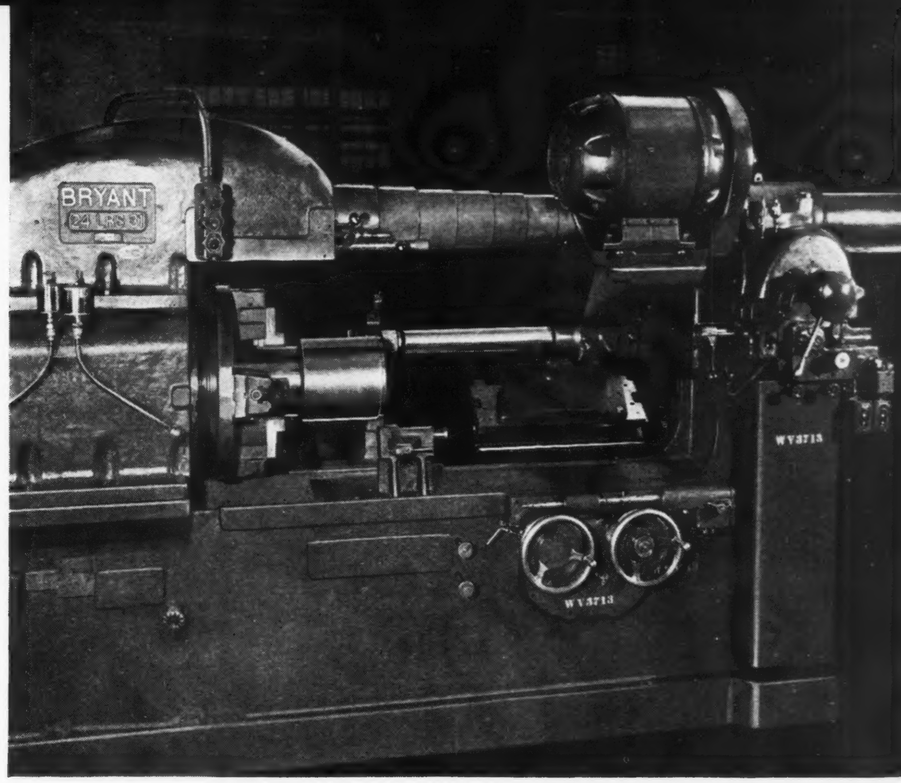


Fig. 6. Finish-grinding the powder chamber in the gun barrel with a cam-controlled wheel on an internal grinding machine in a series of passes

breech end of the tube is threading for the breech-ring. By using a thread miller, as shown in Fig. 7, a stub Acme thread is cut in one-fifth the time formerly required for threading in a lathe. The thread is cut with three passes by a multiple-groove milling cutter, each pass requiring a single revolution of the work.

Several other minor operations, including the milling of keyways and stop surfaces and the cutting of extractor pockets, are necessary on the breech end of the tube. Breech-ring threads are then cut into sectors, using a hydraulic shaper and high-speed steel tools. Houghton "Antisep All-Purpose Base" is used as the coolant in all these operations.

The next step is finish-machining the entire length of the tube. With the exception of the recoil surface, all this machining is done with carbide tools and no coolant. Where tapered zones are required, they are machined with tools controlled by cam plates. The recoil surface is given a 16 micro-inch r.m.s. finish on a Norton cylindrical grinder, using the same coolant base employed in the machining of the powder chamber and the breech end.

Rifling the Barrel and Machining the Muzzle End

After the exterior turning has been finished, the interior of the tube is completed. Up to this point, the tube has been bored, reamed, and rough-honed. It is now ready for honing to finish size and rifling. The finish-honing has already been described.

For the rifling operation, an American push-

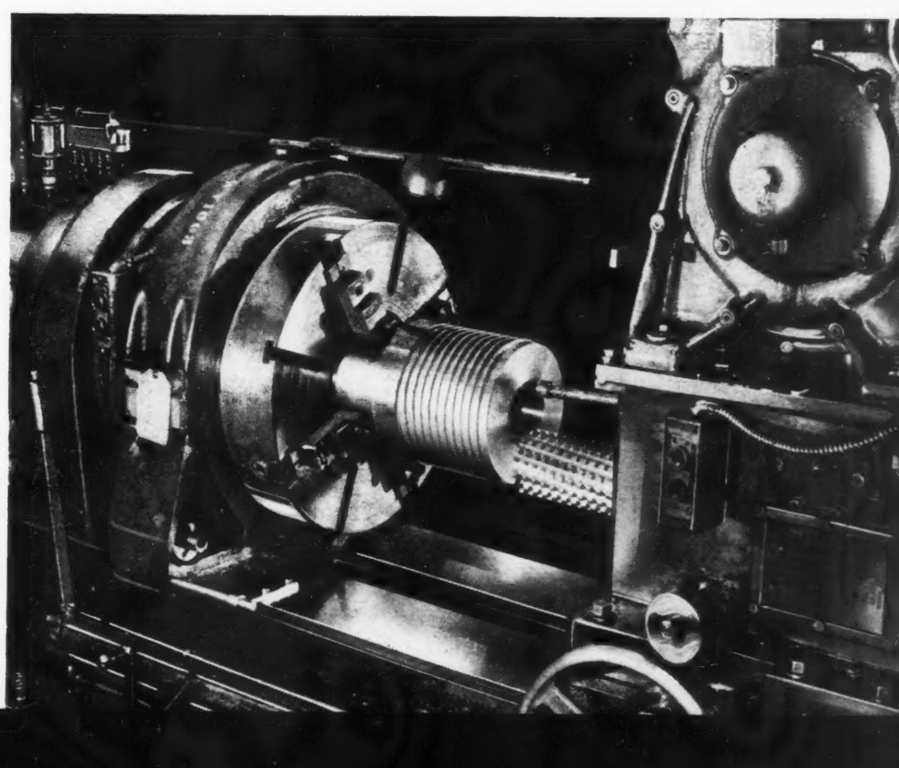


Fig. 7. Threading the breech end of the 90-millimeter gun barrel to receive the breech-ring on a thread-milling machine

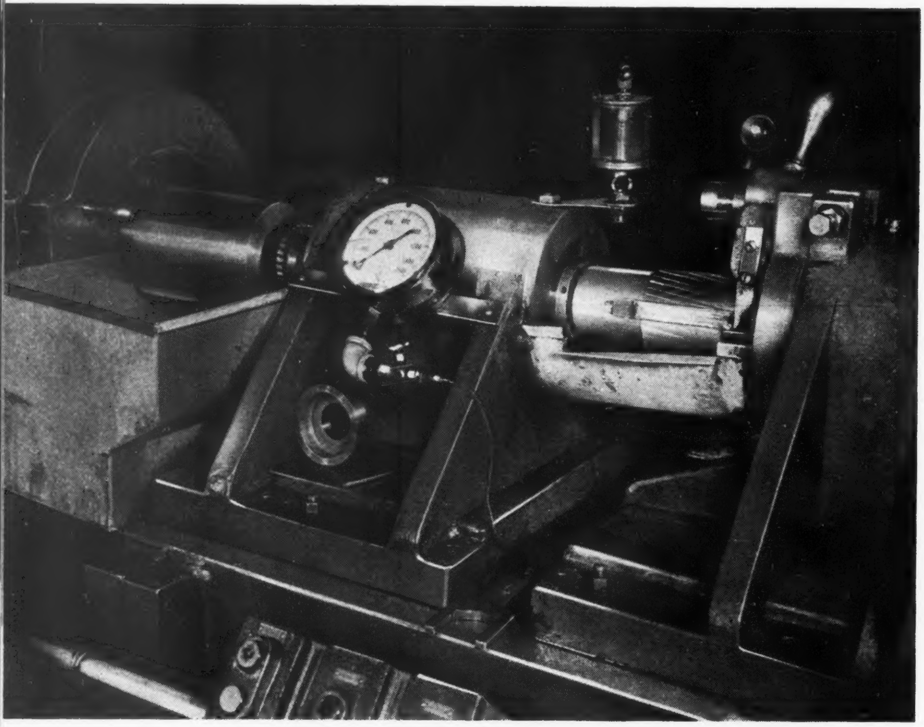


Fig. 8. Close-up view of rifling operation, showing one of the thirty-six broaches used on each gun barrel about to enter gun bore

type machine having a 16-foot stroke and employing thirty-six broaches is used. This machine is illustrated in Fig. 8. A series of high-speed steel cutters, hardened and ground, is pushed through the bore, each successive cutter removing 0.001 to 0.002 inch of material on the diameter. The life of the cutters is greatly affected by the coolant used, and hence the lubricant is carefully chosen. Several mixtures have been used successfully for the purpose; one is Houghton Cut-Max No. 1025; another a 1 to 1 mixture of Houghton light-colored Refrigerant Base No. 10 with kerosene; and a third a 3 to 2 mixture of lard oil with kerosene.

The only remaining major operation in the production of the gun barrel is the machining of the muzzle end. This includes (1) threading to take the muzzle brake, an operation similar to the threading of the breech end; (2) drilling of the bore evacuator tubes in a special drilling and tapping machine; (3) machining of two keyways; and (4) necessary bench operations. In these operations, Houghton "Antisep All-Purpose Base" in a 1 to 30 dilution is used as a coolant.

There are some variations in detail in the operations described in the foregoing, but the sequence and general plan are as outlined.

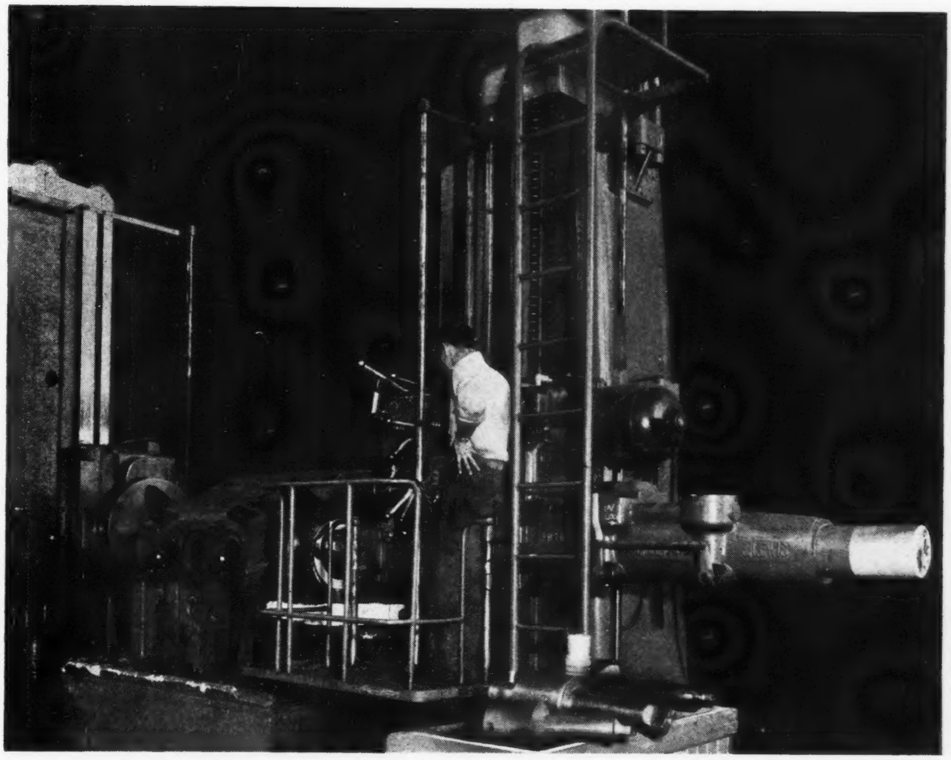
Vacuum Flasks of Unusual Design

Extremely compact vacuum flasks for the storage of cold liquids—such as liquid oxygen and nitrogen — have been designed by the National Bureau of Standards for the U. S. Air Force. Although these flasks are of less than 2 liters capacity, they introduce several new features in dewar-flask design that may well find application in large storage tanks. Two of the designs demonstrate the practicabilty of building invertible dewar flasks that have the same evaporation loss inverted as erect.

One of these containers has a re-entrant type of neck. The neck doubles back into the container and through the liquid, from which it is insulated by an extension of the vacuum space. Thus both the gas and liquid connections are at the bottom of the flask. The minimum conductive heat path is along the neck, which is 11 inches in length — considerably longer, compared to the size of the flask, than the outside necks on standard spherical flasks.

A second container fulfills a further military requirement in that it may be held upside down without increasing the heat leak. The entire inner chamber of the flask is supported within the outer case by two identical neck-drains. The one at the top of the flask serves as a gas vent, while the other, at the bottom, is used for adding liquid. When the flask is inverted, the roles of the two neck-drains become reversed.

The evaporation rates of the new type flasks compare favorably with those of standard spherical containers.



Patton Tank Hulls in Quantity Production

By CHESTER D. LENTZ
Manager, Manufacturing Engineering
Baldwin-Lima-Hamilton Corporation
Eddystone, Pa.

WITH the advent of the Korean War and the subsequent rearmament effort, the United States was faced with the problem of producing war materiel quickly in order that it could supply its armies in the field and its stock piles at home, as well as the member nations of the Free World. The General Patton tank, a 45-ton medium tank powered by a twelve-cylinder gasoline engine and having an automatic transmission, was one of those items of war materiel that was sorely needed. A bottleneck to fast production presented itself in the form of steel and machine tool shortages.

This was the situation in the summer of 1950 when the Baldwin Locomotive Works, Eddystone, Pa., (now the Baldwin-Lima-Hamilton Corporation) offered its facilities to the Federal Government. The Government accepted the offer, and within a month let the first contracts for the production of tank hulls. Baldwin now found itself faced with the problem of tooling up for the production of these tank hulls in the face of steel and machine tool shortages.

The first thing that was done was to survey the plant for material that could be fabricated into production equipment. This search netted 300 tons of steel plates. Jigs, fixtures, and welding positioners were made from this steel at a great saving of time and money. The machine tools were set up and in some cases rebuilt to permit special machining operations to be performed. New welding machines, additional motor-driven welding positioners, and a few new machine tools had to be obtained; but while waiting for the new equipment, other equipment was being improvised. Tooling was completed by January 1, 1951, and the first ten tank hulls were shipped to the Detroit Arsenal before the end of March of 1951. Since that time, the output has steadily increased.

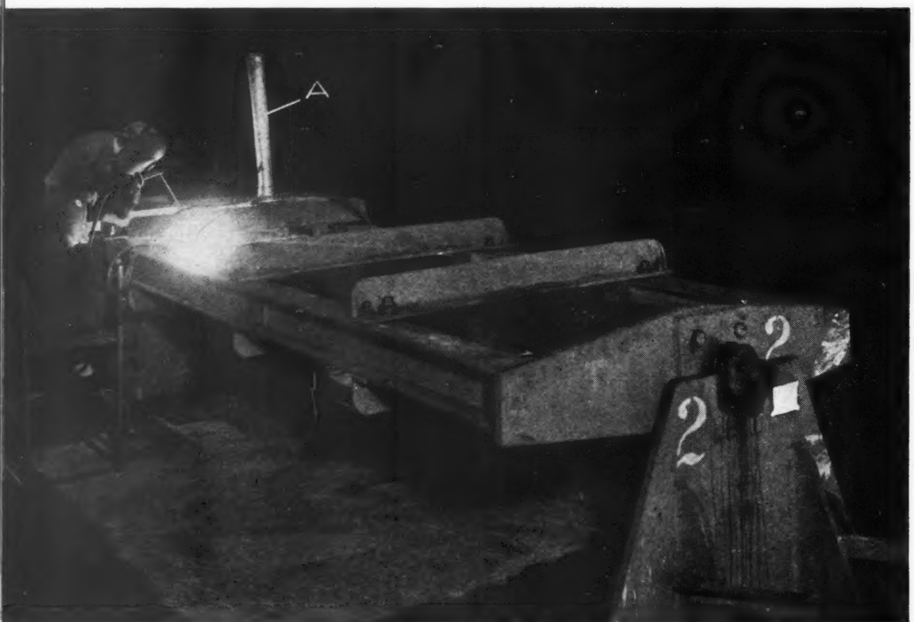


Fig. 1. A welder using the down-hand technique in welding the side plate to the side extension plate while the two plates are held in an improvised positioner. Venturi type exhaust blower (A) carries harmful fumes away from welder

Fig. 2. An improvised welding positioner which facilitates the welding of the slope plates to the bottom plates. This fixture can be rotated about a longitudinal axis

An over-all picture of the production of tank hulls at the Baldwin-Lima-Hamilton Corporation would include welding, machining, and assembling of the different sizes of armor plate and armor castings that make up the M-47 hull. The operations entail welding of all the component parts—namely, the side, bottom, and slope plates, and front, rear, and turret ring castings; machining of various parts; X-ray and visual inspection of the hull; and painting of the hull.

Side armor plate, which is supplied cut to size and shape, with the edges scarfed to an included angle of 90 degrees, is inspected upon receipt, Some edges may have to be machined to size if too large or built up by welding if too small. Following the inspection, the necessary holes are drilled in the side plates.

The first welding operation, other than the preliminary building up, is the welding of the side plate to the side extension plate. The two pieces are laid flat in a fixture with their edges approximately 1/4 inch from each other, as shown in Fig. 1. All welds are made with the electrode in the down-hand position. An exhaust blower *A* is used to remove gases from the working area. Austenitic chrome-nickel stainless-steel welding rod, in 3/16, 1/4, and 5/16 inch sizes, is used for all welding operations. The rod is coated with a titanium type flux, which facilitates the use of alternating-current welding.

Westinghouse alternating-current welding machines of 500-ampere rating are used. Settings ordinarily used on these machines are as follows: For the 3/16-inch rod, 160 amperes; for the

1/4-inch rod, 225 amperes; and for the 5/16-inch rod, 280 to 300 amperes. A minor difficulty encountered was that the welding rods became moist upon standing, and would not perform their function satisfactorily. To remedy this, a small oven was installed, which insures dryness of all the welding rod used.

Slope plates are welded to the bottom plates on positioning fixtures (Fig. 2), conveniently located in relation to the place where the side plates are welded. The plates are kept approximately 1/4 inch apart at the start of the welding operation, which is completed in eighteen to twenty passes.

In the next operation, the previously welded sub-assemblies of the bottom and side plates are positioned on assembly fixtures, together with the front, rear, and turret-ring castings. The required spacing between the various components is 5/16 inch, the parts being built up by welding if the space is too great or ground off with pneumatic grinders if too small. After the correct spacing has been obtained, the components are tack-welded together.

The tack-welds are approximately 3 inches in length and are spaced about 14 inches from center to center on long seams. At joints where three or more components meet, the tack-welds are extended 8 to 10 inches on all seams from the center of the joint. Tubular cross-bars are welded to the inside of the tack-welded hull to prevent distortion during the finish-welding operation, but they are removed prior to performing the final machining operations.

The tack-welded tank hull is lifted by an overhead crane of 25 to 75 tons capacity and lowered on a large surface plate (Fig. 3) for checking the assembly prior to final welding. The hull is supported at four points.

The slope gage used to check the angle of the tack-welded slope plate may be seen at the left in Fig. 3, although it should be noted that the illustration shows a finish-welded rather than a tack-welded hull. The holes that were drilled in the side plates and the tack-welds are visually inspected while the assembly is on the surface plate. If the slope plate angles, side-plate holes, and tack-welds are all approved, the hull is passed on for finish-welding. In case it is rejected, the hull is reworked until it passes this inspection.

Approved tack-welded hulls are fastened at both ends in Worthington or Ransome motor-driven welding positioners, which enable the hulls to be rotated so as to provide maximum opportunity for welding in the down-hand position. Fig. 4 shows a tank hull mounted on a positioner while being finish-welded. Each seam is welded upward from the center of the butted double V-joint. This requires anywhere from twelve to twenty passes, depending upon the thickness of the plates being welded. First the upper half of the butted double V-joint is welded and then the hull is rotated so that the lower half of the V-joint faces upward, after which the welding of the joint is completed. Following each pass, the slag and deposited flux are removed by chipping. The joint is inspected before the next pass is made.

The finish-welded tank hull is now sent back to the surface plate, where the center lines and suspension-bracket and escape-hatch holes are laid out and marked off. Those areas that have to be built up for subsequent machining opera-

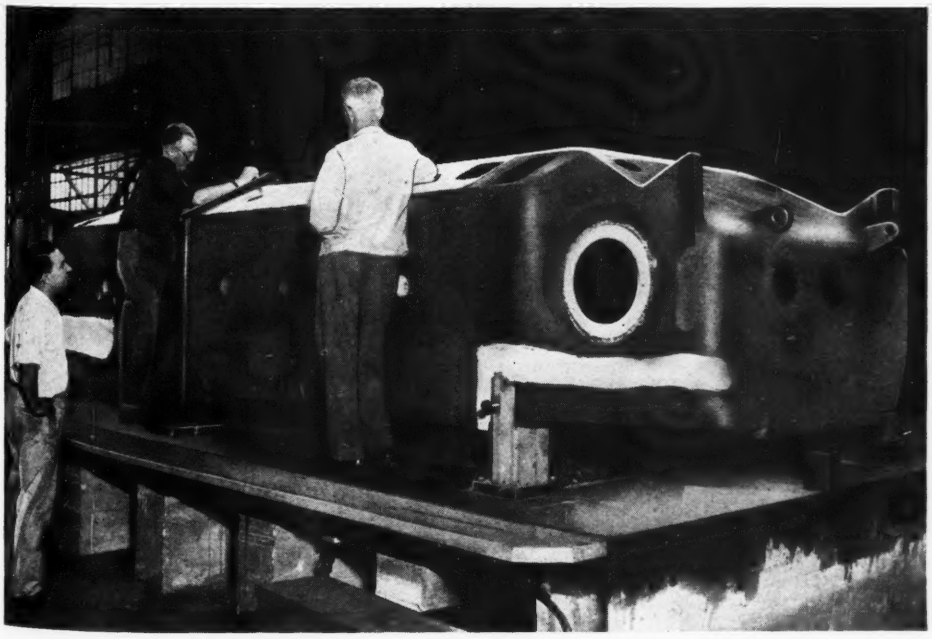


Fig. 3. Inspecting and laying out a finish-welded tank hull on a large surface plate. This operation is performed by a crew of three men

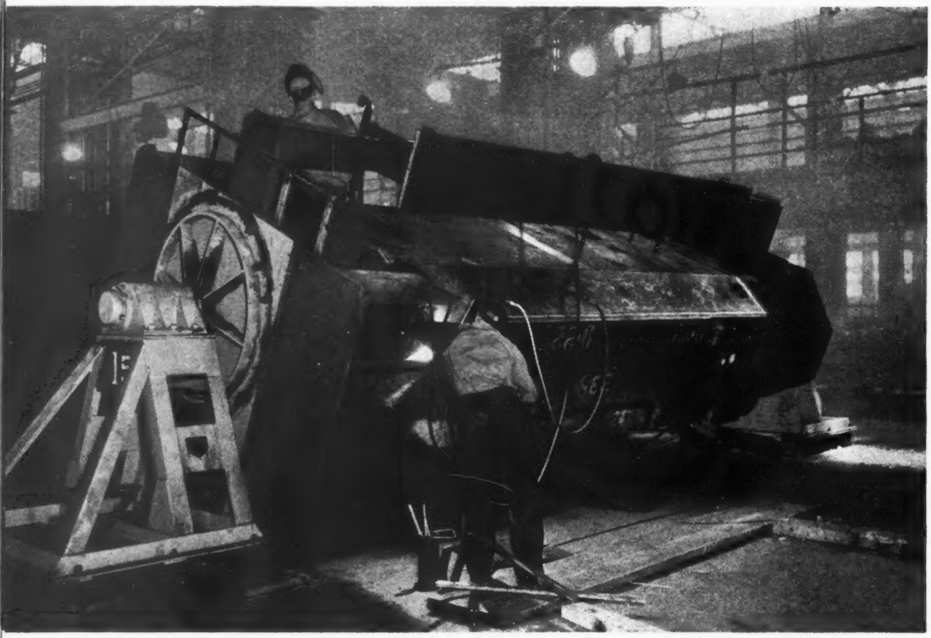


Fig. 4. Finish-welding a hull on a motor-driven positioner, which enables the work to be rotated to the most convenient position for efficient welding

tions are also marked. The inspection and lay-out of a finish-welded tank hull is seen being performed in Fig. 3.

An example of Baldwin ingenuity is exemplified in the design and operation of the gas cutting equipment used to cut the suspension-bracket and escape-hatch holes in the hull. The operation shown in Fig. 5 is performed with the hull supported in a two-position stationary fixture. This fixture provides for flat, horizontal positioning of either of the two slope plates.

In cutting the suspension-bracket hole in the slope plate, a specially designed motor-driven pantograph type machine using an Oxweld oxy-acetylene torch is employed. The torch cuts the hole to the required shape as an electrically driven member of the pantograph automatically follows the form of a template seen mounted above the slope plate. Cutting speeds range from 7 inches per minute for escape-hatch holes to 10 inches per minute for suspension-bracket holes.

A General Electric X-ray machine rated at 1,000,000 volts and 3 milliamperes is used to photograph all of the welded seams in a finish-

Fig. 5. Cutting suspension-bracket hole in the slope plate of a hull by the use of a gas torch and a motor-driven pantograph machine

welded hull to detect any flaws, such as slag inclusion, non-fusion, and porosity. This machine, shown in Fig. 6, is hung from a movable support in a specially constructed X-ray room that prevents the harmful rays from escaping to the surrounding building. In the process of X-raying a hull, ninety different photographs must be taken to obtain complete inspection of the welded seams. Pictures are taken with either the down port or the side port of the machine, thereby eliminating a great deal of turning of the work on the positioner. As much as 15 inches of welded seam can be inspected with one photograph.

X-ray photographs can be processed and made ready for an analysis in about forty minutes, and a hull can be X-rayed completely in five to six hours. If a tank hull is rejected because of flaws in welding, the rejected portions of the welds are removed and the hull is rewelded. The rewelded sections are then X-rayed to determine their quality.

After the X-ray inspection, a series of machining operations is performed on the finish-welded tank hulls. Briefly, these consist of a few boring, facing, and drilling operations on the various component parts of the hull.

One of the operations is the boring and facing of the main-drive bore and idler holes. This is done in the special set-up shown in the heading illustration which consists of a fixture that supports and locates the work and four Giddings & Lewis horizontal boring mills, one at each corner of the fixture. Positioning of the hull in the fixture is accomplished by utilizing the center lines that were laid out on the surface plate. Each of the holes is machined by one of the horizontal boring mills.

In the case of the idler holes, the operation consists of boring and facing both 6- and 7-inch concentric holes. Approximately 1/4 inch has to be removed from the diameter of each hole. The boring is done with a single-point carbide-tipped tool. Rough-boring is performed at 65 R.P.M. with a feed of 0.012 inch per revolution, and finish-boring at 57 R.P.M. with a feed of 0.006 inch. The limits for both holes are plus 0.0015 inch, minus zero. In machining the main-drive bore, approximately 1/2 inch is removed from the diameter. The limits on this operation are plus 0.010 inch, minus zero.

Flanged drill jigs are placed in the finish-machined idler and main-drive holes to locate the positions of other necessary holes, which are then drilled and tapped. Following this, flanged locating mandrels are fastened to the tapped holes for locating purposes in subsequent machining operations.

Another operation on the tank hulls consists of machining surfaces on the slope plates to accommodate the suspension-bracket plates. Fig. 7 shows this operation being performed on an Ingersoll horizontal milling machine. An 8-inch diameter milling cutter containing eight 3/4-inch square carbide-tipped tools is used at a speed of 52 R.P.M., with a feed of 2 1/2 inches per minute. Only one cut is taken, removing 1/16 to 1/4 inch of metal.

A unique method of drilling holes for fastening the suspension brackets to the slope plates employs a Sellers way type multiple-spindle drilling machine, Fig. 8. Two tank hulls can be mounted end to end on the supports between the two ways of the drilling machine. There are three drilling spindles on each way. The ways are inclined to a given angle so that the axes of the spindles are always perpendicular to the surface of the slope plates.

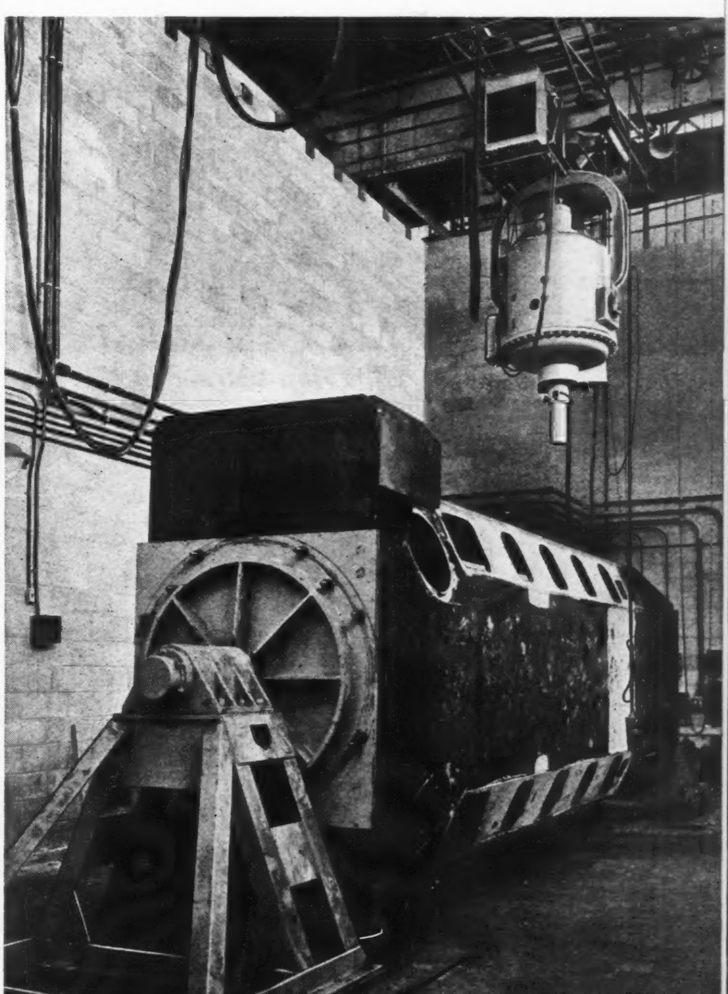


Fig. 6. X-ray photographs are taken in a specially built room with the set-up here illustrated. The X-ray machine hangs from a movable supporting carriage above the hull

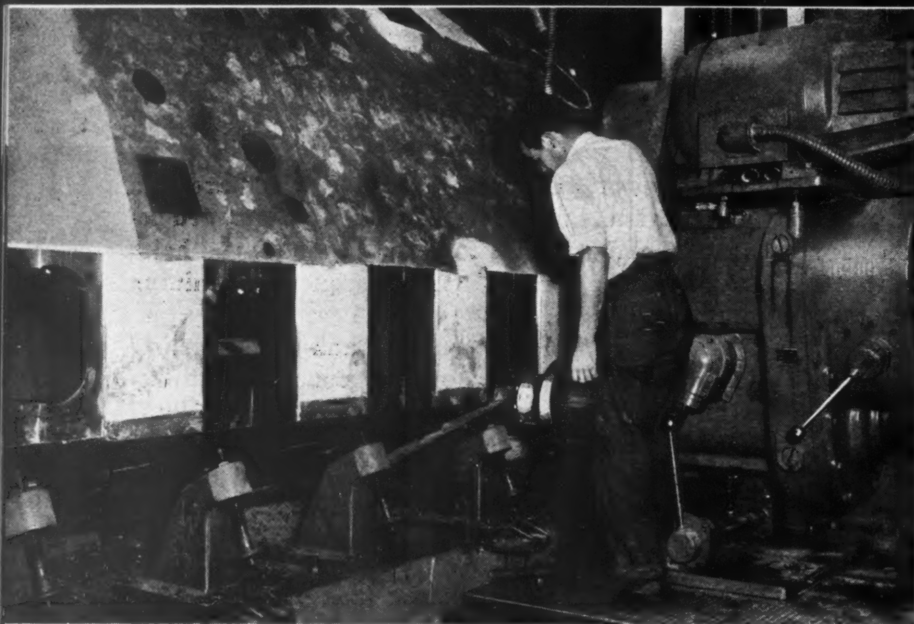


Fig. 7. Surfaces around previously cut suspension-bracket holes are machined on an Ingersoll horizontal milling machine. Only one cut is taken, removing 1/16 to 1/4 inch of metal

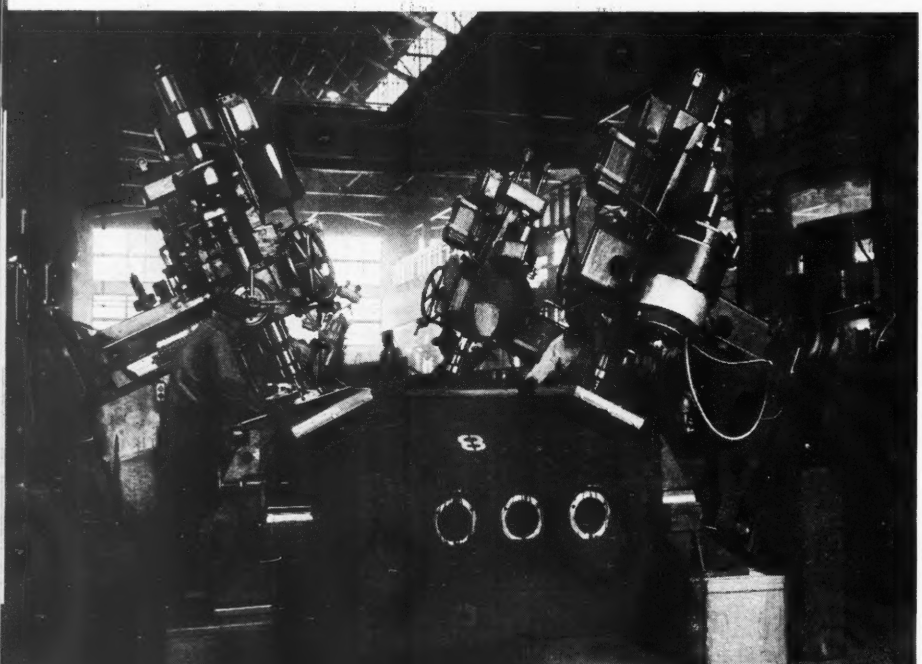


Fig. 8. This Sellers way type multiple-spindle drilling machine drills suspension-bracket fastening holes in both sides of the slope plates

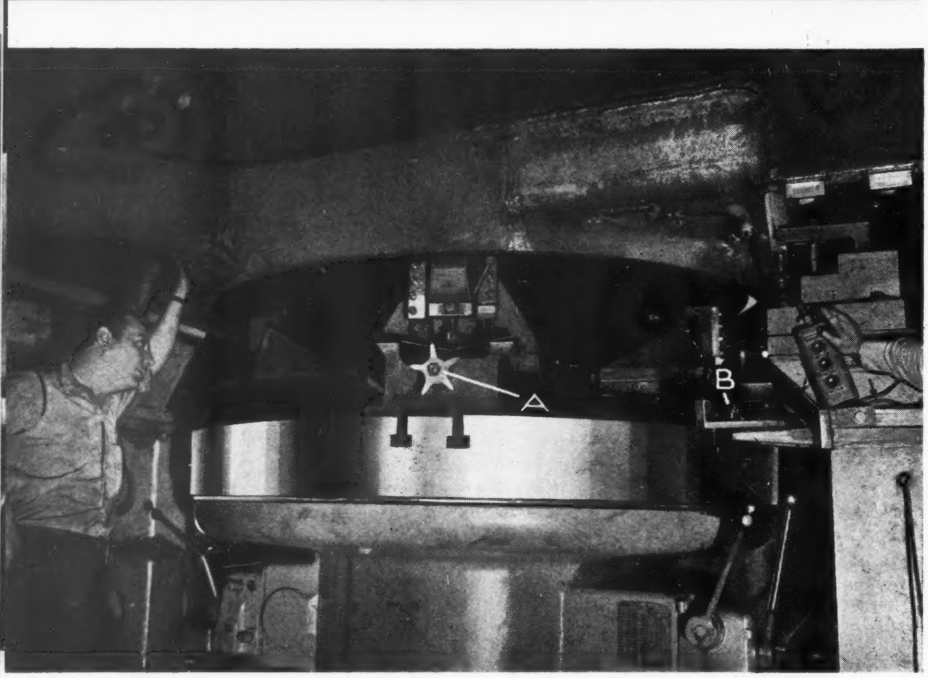


Fig. 9. A unique set-up in which boring and facing heads are mounted on the revolving table of a horizontal boring mill for machining the turret ring. Star-wheel feeds are employed

Drill jigs are placed over the slope plates on each side. Although there are three drilling spindles on each way, only two of them are used simultaneously on each side of the tank hull.

Radial drilling machines are used to drill and tap holes for the engine compartment cover, and horizontal drills for the transmission pads. The suspension brackets are fastened by means of bolts and nuts, and all internal welding is completed before final machining.

The final machining operation is the facing and boring of the turret ring, which is approximately 80 inches in diameter. For this operation, the tank hull is inverted, again being supported on the four locating mandrels. Beneath the turret ring and concentrically located in relation to it is the revolving table of a vertical boring machine, Fig. 9. Fastened to this table are two boring heads and one facing head.

All the heads are equipped with a star-wheel feed which operates in the following manner: During the revolution of the table, as the star-wheel *A* of each head comes in contact with a member *B* fastened to the machine frame, the star-wheel is rotated one-fifth of a revolution. This movement is transmitted through gearing to the tool-heads, resulting in a vertical feeding movement of the boring head and a horizontal feeding movement of the facing head.

Kennametal K2S carbide-tipped 1-inch square tools are used for these operations. For rough boring and facing, a speed of 1.7 R.P.M. is maintained, whereas for finish boring and facing the speed is 8 R.P.M. In both operations, a feed of 0.032 inch per revolution is used. The limits on the inner bore are plus 0.013 inch, minus zero, and on the outer bore, plus and minus 1/32 inch. Machining of the turret ring is one of the last operations performed on the tank hull, since it was found that any subsequent internal welding tended to distort the trueness of the ring.

The final step is the painting of the entire hull prior to loading on a flat car for shipment to the Detroit Arsenal, where the tank is assembled and made ready for combat.

* * *

Scholarship Program to Encourage Industrial Careers

Ten annual scholarships are being offered to high school graduates by the Utica Drop Forge & Tool Corporation. The scholarships provide for two school years of training in the Department of Mechanical Technology of the New York State Institute of Applied Arts and Sciences, Utica, N. Y. Each student is expected to work in a manufacturing plant in the summer months.

Continuous Annealing Line

Eleven separate processes are performed at stages along a 3000-foot length of sheet steel as it travels at a speed of 1000 feet a minute through a new continuous annealing line in the United States Steel Co.'s sheet and tin mill at Gary, Ind. The entering end of a fresh coil of semi-finished sheet is welded to the end of the preceding coil as each length is given a uniform heat-treatment preparatory to finishing into stock for cans. The welding time is three seconds, and the time required for the entire coil change is twelve seconds. The new annealing line takes the place of traditional batch annealing under covers, coil by coil, in a furnace.

Each sheet, as annealed, is suitable for manufacture into almost any kind of can. The coils measure from 30 to 66 inches in diameter, and weigh from 5000 to 30,000 pounds each. They are delivered from a five-stand cold-reduction mill. The annual capacity of the line is approximately 136,000 tons of sheet steel, ranging from 0.0075 to 0.015 inch thick in widths 36 inches and less.

* * *

World's Most Powerful Wind Tunnel Drive being Built

The world's most powerful wind tunnel drive —a 250,000-H.P. unit capable of creating supersonic blasts of air—is being constructed in Schenectady, N. Y., by the General Electric Co. The giant drive will be installed in a wind tunnel now being built at the Lewis Flight Propulsion Laboratory in Cleveland, Ohio. The new tunnel will be used to test aircraft power plants in the ram-jet, gas turbine, and rocket categories.

While rated officially at 250,000 H.P., the drive will have a peak one-hour output of 300,000 H.P. It will consist of four 37,500-H.P. and three 33,334-H.P. variable-speed, alternating-current induction motors, linked to two axial-flow compressors. The individual motors will each weigh about 120 tons.

* * *

In eleven years, from 1939 to 1950, American industry increased its use of power from 81,200,000,000 to 189,700,000,000 kilowatt-hours —134 per cent. In the same period the industrial production index went up 83 per cent. This means that industry is now using some 27.5 per cent more energy per unit of production—a clear indication that the process of supplementing manpower with electric power continues at an accelerated rate.

Revolutionary Method of Cooling

By Directing Small High-Speed Jets of a Special Oil from below the Cutting Tool to the Line of Contact between the Work and the Cutting Edge, Efficient Lubrication and Improved Heat Removal are Obtained. Tool Life Can be Greatly Lengthened and Cutting Speeds Substantially Increased

TWO outstanding developments for efficiently cooling and lubricating cutting tools have been announced by the Gulf Research & Development Co., a subsidiary of the Gulf Oil Corporation, Pittsburgh, Pa. Comprehensive tests have indicated that these developments—the "Hi-Jet" lubricating and cooling system and Gulf "Hi-Jet" oil—can increase the life of high-speed steel cutting tools from six to twelve times and carbide tools from three to five times, and that cutting speeds can be doubled. These improvements are possible without any radical changes in existing equipment and at a moderate cost.

With the "Hi-Jet" method, small high-speed jets of the special oil are directed on the cutting edge of the tool from below, as seen in Fig. 1. The streams of oil pass upward through the wedge-shaped air space between the work and the side relief face of the tool, and are aimed at the line of contact between the work and the cutting edge. Part of the oil is forced past the cutting edge and between the chip and the tool, thus efficiently lubricating the tool and improving the rate at which heat is removed.

Proof that the oil actually does pass the cutting edge is the fact that the chips leaving the contact area are coated with oil. The pressure of a few hundred pounds per square inch used in this method is not sufficient to push liquid oil past the edge, where a pressure of 50,000 pounds per square inch or higher is encountered. But since the edge temperature is well above the boiling point of the oil, the liquid is vaporized and thus can be forced through the slight irregularities that exist in both the cutting edge and the work surface, which form tiny passages.

In the process of vaporizing, the oil picks up considerable heat from the most critical area—the cutting edge. This action partially accounts for the improved cooling effect provided. The flow of excess liquid oil outward along the under side of the cutting edge also removes heat. The condensed liquid oil is trapped between the tool and the chip, where it is needed to reduce frictional resistance to chip motion.

The entire unit consists of a jet, or a series of jets, flexible tubing, and a small motor-driven pump, Fig. 2, capable of providing a pressure of 400 pounds per square inch. "Hi-Jet" systems

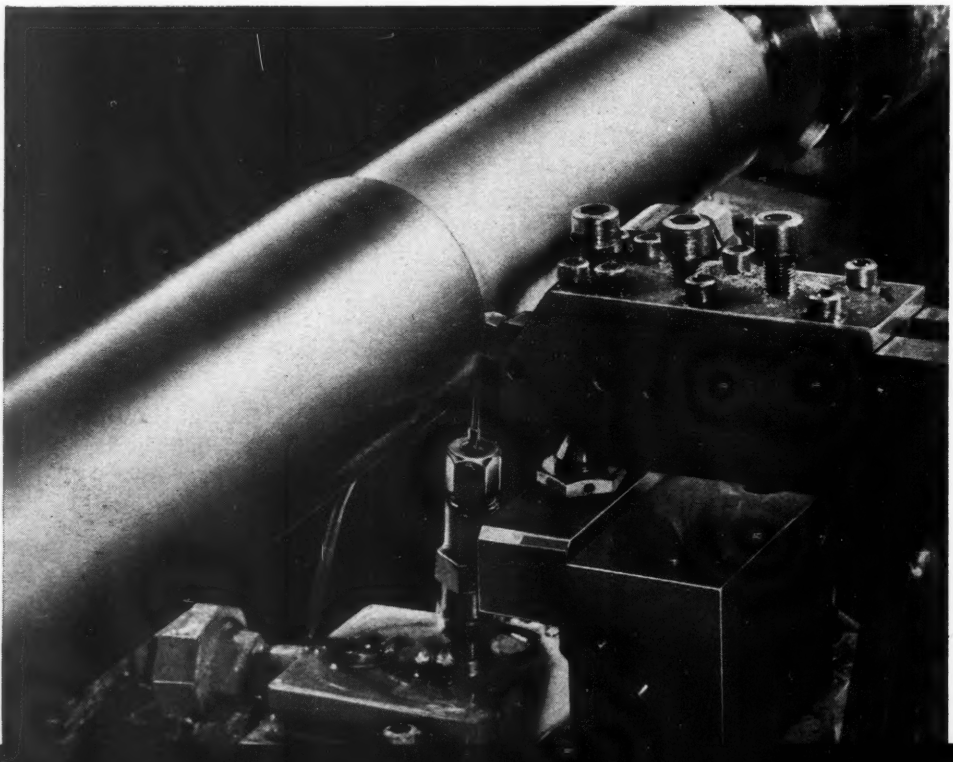


Fig. 1. High-speed jets of oil, directed on the cutting edge of the tool from below, efficiently cool and lubricate the tool

and Lubricating Cutting Tools

will be manufactured by Thompson Products, Inc., of Cleveland, Ohio, under licenses from the Gulf Research & Development Co.

During the course of the experimental work, it became evident that the nature of the oil has an important effect on the operation of the system. With some oils, the results are only slightly better than with the conventional overhead flood method, but with others the results are outstanding. Because of this, an intensive development program was launched to determine what oil properties affect the efficiency of the "Hi-Jet" system and to incorporate all the desirable properties into one oil that will produce the best possible results. More than fifty different oils and additives were investigated, and one by one the less desirable were discarded. This entailed the development of thirty-five new oils, in addition to the testing of over fifteen existing oils.

In the test work, every effort was made to reduce all variables to a minimum. All tests were made on a standard Warner & Swasey turret lathe, which was rigidly constructed. Specimens of each type of steel were taken from a single heat and carefully heat-treated to maintain the highest possible degree of uniformity in machinability. A toolpost dynamometer employing the air-gage principle was developed by Gulf Research engineers to measure the forces in the single-point cutting operations. The temperatures generated at the cutting edge were accurately measured by using the work and tool as a thermo-couple.

The tools were carefully ground to a standard finish in jigs. No hand-stoning was permitted because of the difficulty of controlling this operation. The tool dimensions in all cases were those recommended for the type of steel tested. "Tool life" signifies the duration of the operation, in minutes, before the tools failed. The test was set up so that each tool failed in from three to six minutes when cutting without lubricant in an effort to shorten the duration of the "Hi-Jet" test from a matter of days to a couple of hours.

The majority of the more than 600 tests were made on SAE 1020, AISI 3140, and SAE 3150 steels with high-speed steel tools. The average results obtained are shown in the accompanying table. However, additional tests have been made on stainless steel with high-speed steel tools and another series of tests was made on SAE 3150 steel with carbide tools. Good results have also been obtained in machining titanium alloys. One of the most amazing characteristics of these tests was the consistency of the results produced with the new system. Tool life under test conditions never varied more than $\pm$ 25 per cent, and was usually within $\pm$ 10 per cent for a given set of test conditions.

At Thompson Products, Inc., additional tests were run on a production basis on Inconel M and AISI 8742 with carbide tools. On aircraft valves made of Inconel M, the number of pieces machined per tool grind by the old method was extremely low because of the tough, gummy nature of this nickel-chromium alloy. The operation was performed on a Bardons & Oliver turret lathe, with the work rotating at 67 surface feet per minute, a tool feed of 0.065 inch per minute, and a depth of cut of 0.075 inch.

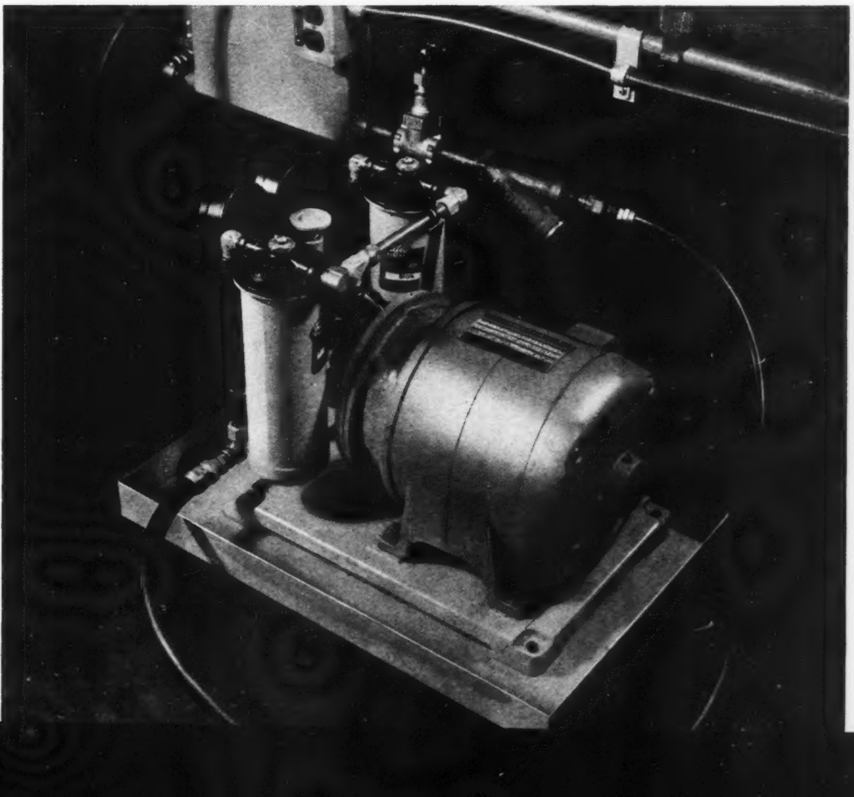


Fig. 2. A motor-driven pump provided with filters and gages forces oil through flexible tubing to the nozzle under a pressure of 400 pounds per square inch

When the new system and oil were applied to the job, the number of pieces machined before tool regrinding was necessary was increased at least three times. Five streams of oil were directed on the 0.312 inch wide cutting edge of the carbide tool. In the second group of tests, on a 3-inch diameter shaft of AISI 8742 steel, a 3 to 1 improvement in tool life was produced with the "Hi-Jet" method.

It is believed that the new method will find widest application at first on turning operations, simply because it can be more easily applied to lathe tools. However, with suitable nozzle designs and attaching fixtures, the system is practical for many other types of machining operations. Good results can be produced on most types of lathe and boring mill work, but the most remarkable savings will be made on high-production jobs, where tool life is abnormally short.

The "Hi-Jet" system is especially practical for jobs where set-up time is high in relation to operating time on the machine or where a great number of tool changes are required. It is also advantageous for low-speed operations where large amounts of metal must be removed.

The new method is also suitable for use on most types of single-point or form tools, external broaches, certain types of drills, milling machines, gear-cutting equipment, chucking machines, multiple-spindle automatics, and some types of grinding machines. For many of these applications, special nozzles, deflecting devices, mounting attachments, and valve arrangements are being designed.

The suction side of the system is connected to the regular coolant system, and the discharge end is connected by flexible hose to the jet nozzle, which is held in the nozzle-holder and attached by a suitable fixture to the cross-slide or toolholder of the lathe. In order to reduce chip interference, which must be avoided at all costs, the jet nozzle should be mounted in such a way that it is not more than 2 or 3 inches from the cutting edge of the tool. The stream of oil should be carefully aimed and firmly held, so that it is always in contact with the cutting edge.

Since the "Hi-Jet" oil gets to the exact point of contact between the cutting tool and the work surface, a great deal of heat is carried away, and as a result a considerable amount of smoke is

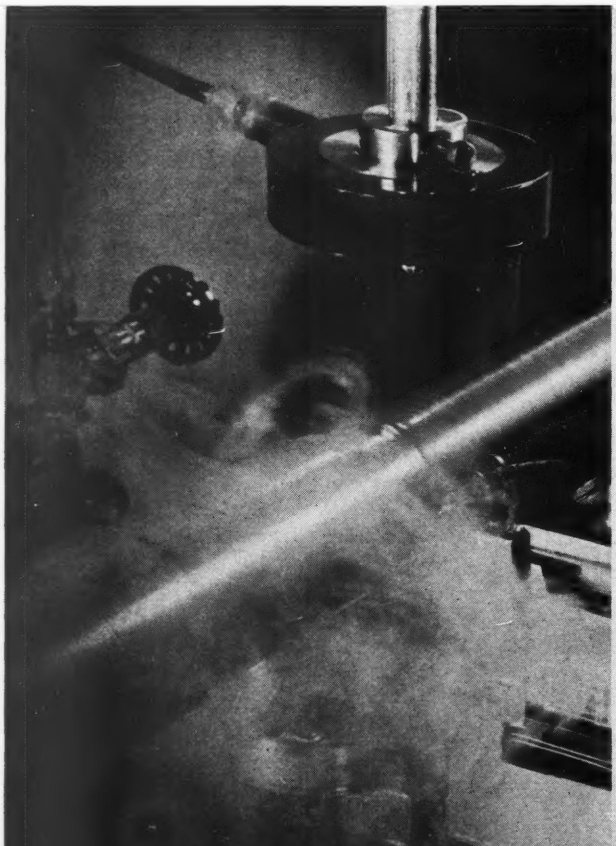


Fig. 3. Since the "Hi-Jet" oil reaches the cutting edge of the tool, which is at the highest temperature, a great deal of heat is carried away and a considerable amount of smoke is generated

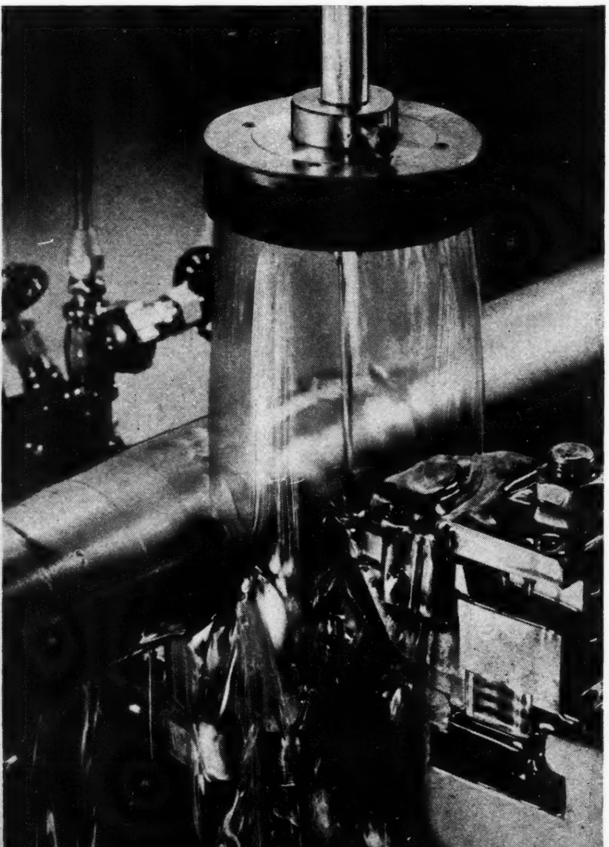


Fig. 4. Shower heads located both above and below the "Hi-Jet" nozzle form a continuous but thin oil curtain, which effectively absorbs the smoke generated by the new method

generated, as is apparent in Fig. 3. For this reason, a number of attachments have been developed which will serve as smoke quenchers. One of these incorporates shower heads, placed above and below the cutting surface, as seen in Fig. 4. This will utilize the available overhead flood equipment, and by using the liquid to form a thin curtain, provides an effective smoke quenching medium. The addition of this equipment, however, in no way influences the operation of the system, since it is merely a smoke quencher and not a lubricating or cooling device.

One of the outstanding advantages of this system is that the operator has the choice of operating his machine at conventional speeds with greatly increased tool life or doubling, and sometimes even tripling, the speed of operation without reducing the tool life. Two to three times the amount of cooling is obtained with one-twentieth of the oil circulation.

In addition to the advantages mentioned, the "Hi-Jet" system offers other indirect advantages. As a result of increased tool life, set-up and tool grinding time can be greatly reduced on many jobs. And because the tools last longer, fewer tools are needed. On large production jobs, this means substantial savings in tool inventory and tool cost.

It seems certain that with the improvements made possible by the new system in increasing tool life and cutting speeds, the use of high-speed tool steels will be greatly extended. This is highly desirable at the present time because of the scarcity of sintered tungsten carbides and the increasing demands brought about by the defense program.

Because of the improved cooling and lubricating action on the tool radius, surface finish of the work is greatly improved with the new method. Test results have shown a reduction in surface roughness from 200 to 60 micro-inches r.m.s. Even where improvements in surface finish are not so pronounced, greater dimensional stability usually results, since the effects of tool build-up and radius wear have been practically eliminated.

An important advantage of the improved surface finish and dimensional accuracy of work obtained when the "Hi-Jet" system is used is the reduced need for additional finishing operations. In some cases, the finishing operation can be entirely eliminated. Grinding time, too, can often be reduced because of the smaller dimensional variations. Another advantage is that there is less tendency for the machined parts to work-harden. On some jobs, this may mean that stresses which cause distortion and surface hardening are reduced.

Average Results of Tests Conducted in Turning Various Steels with Different Cutting Fluids

Type of Steel Machined	Cutting Conditions			Shape of Solid, Single-Point Turning Tool*							Tool Life with Overhead Flow of Conventional Coolant		Tool Life with "Hi-Jet" System
	Speed, Surface Feet per Minute	Feed, Inch per Revolution	Depth of Cut, Inch	Normal Back Rake Angle, Degrees	Normal Side Rake Angle, Degrees	Normal End Relief Angle, Degrees	Normal Side Relief Angle, Degrees	End Cutting Edge Angle, Degrees	Side Cutting Edge Angle, Degrees	Nose Radius, Inch	Type of Cutting Fluid Employed	Time, Minutes	Time, Minutes
SAE 3150	110	0.011	0.150	10	12	8	10	6	6	3/64	Mineral oil and lard oil	10.02	177
											Sulphurized mineral oil	12.60	
AISI 3140	140	0.011	0.150	10	12	8	10	6	6	3/64	Sulphurized mineral oil	9.3	339.5
											Sulphurized mineral oil and lard oil...	24.0	
											Sulphurized lard oil	16.0	
											Mineral oil and lard oil	23.0	
SAE 1020	212	0.033	0.125	0	8	8	8	8	5	1/32	Soluble oil	1.27	19.5
AISI 416 Stainless	160	0.011	0.150	10	12	8	10	6	6	3/64	Mineral oil	9.4	163.4

*All cutting tools employed in these tests were made from 18-4-1 high-speed steel.

Pipe and Fittings for

Various Types of Valves, Transmission Lines, and Fittings Commonly Used in Hydraulic Systems, and Some of the Factors to be Considered in Selecting and Using Them

HYDRAULIC transmission lines, made up of pipe, tubing, valves, and fittings, are as important to the efficient operation of a hydraulic system as wire and conduit are to an electrical circuit. It is essential that oil transmission lines be carefully designed and fabricated to avoid undue resistance to flow, so that power losses may be held to a minimum. At low velocities, this resistance is negligible, although it is considerable at high velocities, depending upon the cross-sectional area of the line, the condition of the interior surfaces, and the number of changes in direction of flow, among other considerations. In general, pipe or tubing used for this purpose must be strong enough to withstand the maximum pressures used in any particular circuit, and, of course, it must be clean and large enough to permit the required flow of liquid, with a minimum of resistance.

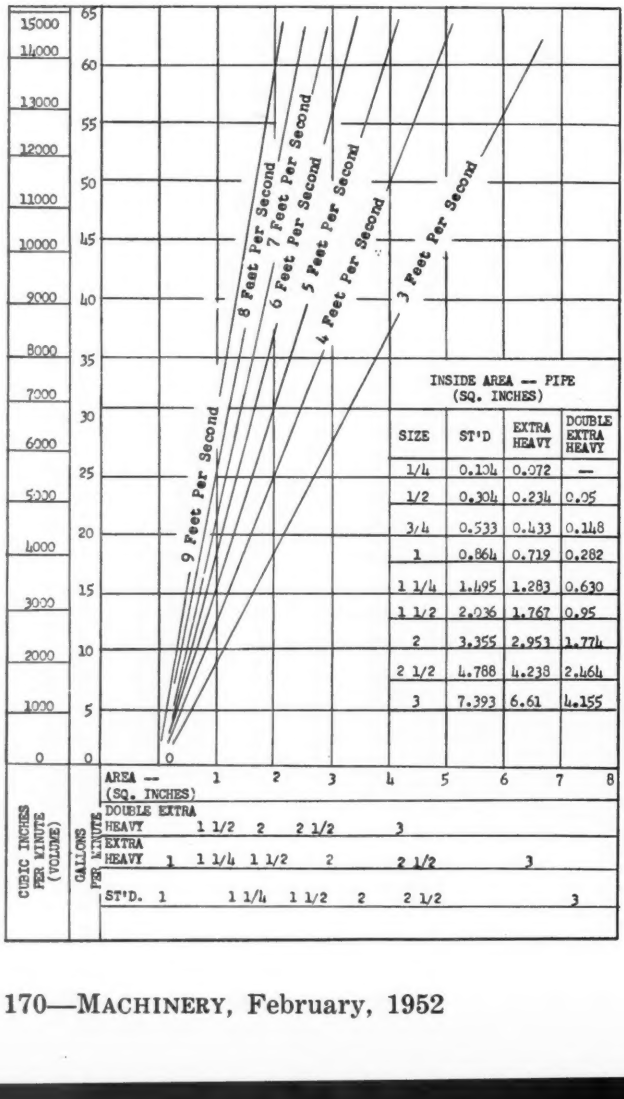
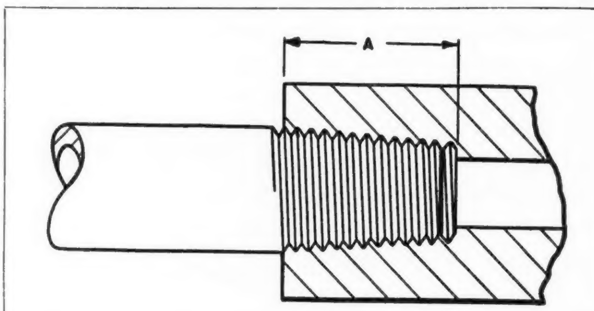


Fig. 1. Graph showing pipe sizes of different weights required to transmit various quantities of hydraulic oil at different rates of flow

Fig. 1 is a graph illustrating various rates of flow obtainable with different sizes of pipe under three classifications—"standard," "extra heavy," and "double extra heavy." It can be seen, for example, that 9240 cubic inches, or 40 gallons, of liquid per minute, transmitted through the lines at a velocity of 9 feet per second will require a standard pipe having an internal area of about 1 1/4 square inches. When the requirements fall between two sizes, the larger is generally chosen. In this case, 1 1/4-inch pipe, having an area of 1.495 square inches, would be used, assuming standard weight pipe to be suitable.

Table 1. Recommended Length of Thread for Hydraulic Fittings and Pipe



Pipe Size, Inches	Length of Thread A, Inches	Pipe Size, Inches	Length of Thread A, Inches
1/8	3/8	2	1 1/16
1/4	1/2	2 1/2	1 1/4
3/8	1/2	3	1 3/8
1/2	5/8	3 1/2	1 7/16
3/4	11/16	4	1 1/2
1	13/16	4 1/2	1 9/16
1 1/4	7/8	5	1 5/8
1 1/2	15/16		

The American Standards Association has published a standard that establishes a system of schedule numbers to designate pipe wall thicknesses. In this system, "Schedule 40" supersedes standard weights; "Schedule 80" takes the place of extra heavy; and "Schedule 160" signifies double extra heavy. All weights of one size pipe have the same outside diameter, the inside diam-

Industrial Hydraulic Systems

By GEORGE N. DORR, President
Dorr-Patterson Engineering Co.
Detroit, Mich.

eter depending on the wall thickness. These schedule numbers are an approximation of the expression $100 \times \frac{P}{S}$, where P is the service pressure, in pounds per square inch, and S is the allowable fiber stress, in pounds per square inch, for a given material at a stated temperature.

An oil hydraulic system may be made up in various ways, depending upon the hydraulic fluid to be used, type of service, maintenance and replacement considerations, size and operating conditions, and other factors. One way is to employ screwed fittings and threaded piping for installations in which pipe sizes do not exceed 1 1/4 inches and pressures are not over 1000 pounds per square inch. In installations of this type, the threads must be cut accurately and to the proper length. Recommended thread lengths for fittings with various sizes of pipe are shown in Table 1.

Thread sealing compounds should be used with care, and should never be employed in an effort to overcome the deficiencies of defective threads. In all such installations, the cut ends of tube, nipples, or pipe should be chamfered to facilitate joining and reamed to remove burrs. Before a pipe or tube is connected in a system it must be thoroughly cleaned inside. Union connections are generally employed for valves and pumps, so that they can be removed easily.

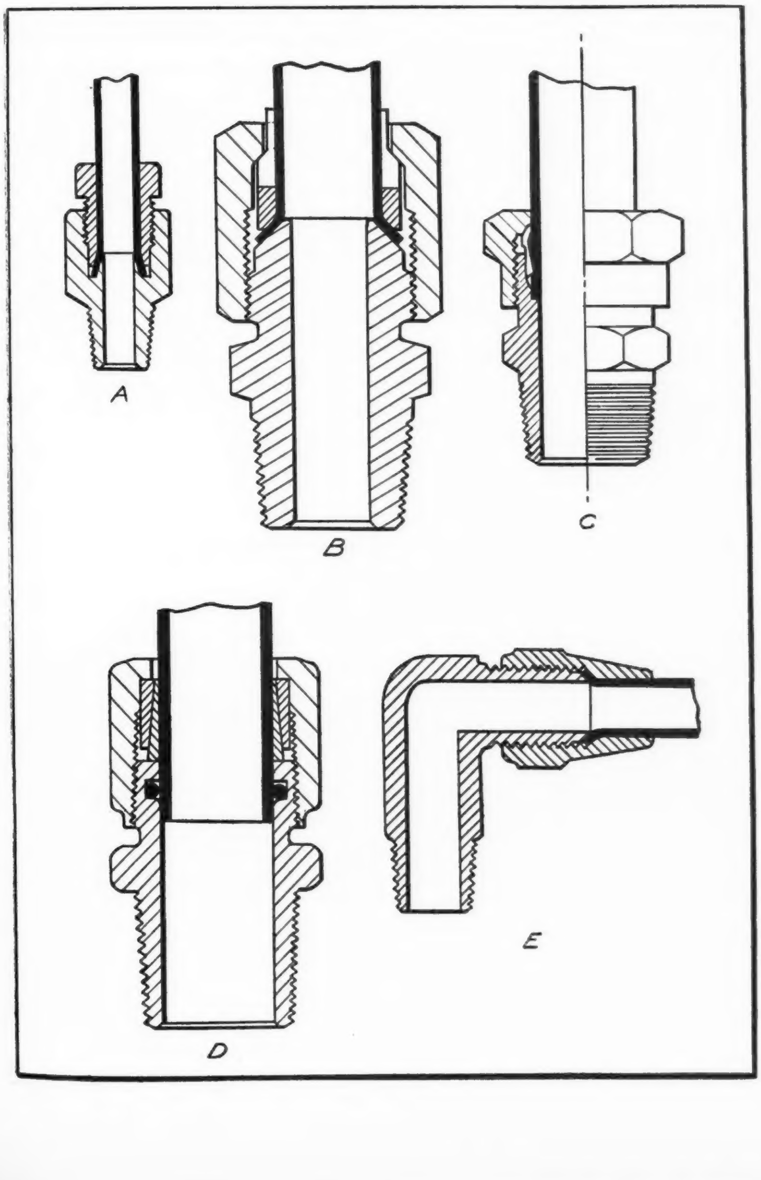


Fig. 2. Fittings with male or female pipe threads at one end and the other end adapted to receive union nuts for securing tubing are available in a wide range of shapes and sizes for hydraulic systems

In making up hydraulic systems of the smaller sizes, about 1-inch pipe and pressures up to 5000 pounds per square inch are widely used. Threaded fittings and flared tubes are generally employed in such installations. As shown in Fig. 2, the fittings have a male or a female pipe thread on one end, while the other end is adapted to receive a union nut to secure tubing to the fitting. Tube connectors such as those illustrated are available in a wide range of shapes, including elbows, T's, straight connectors, etc.

At *A* is shown a Parker inverted type flared tube coupling in which the tube is squeezed between the sleeve nut and the cone of the fitting when the nut is tightened. This pressure makes a fluid seal, the flare acting as a gasket. With this construction, the sealing seat is protected from damage, and a minimum length fitting, as well as a longer sealing surface, results. The Flodar "griptube" fitting, shown at *B*, uses a floating sleeve within the tube nut. The sleeve is slotted at

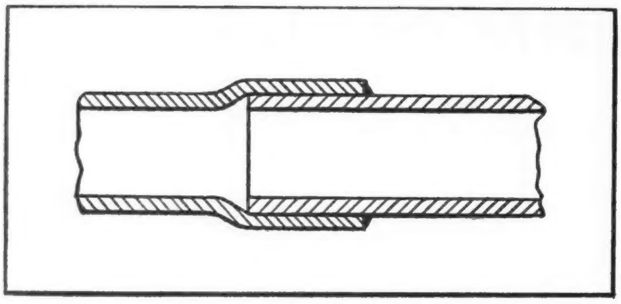


Fig. 3. Where hydraulic pressures are relatively low, soldered tube joints may be used to form a simple connection

one end, as shown, to produce a collet action for holding the tube when the nut is tightened and to reduce vibration. The other end of the sleeve, which contacts the tube, is solid.

At *C* is shown the Weatherhead "Ermeto" fitting, which utilizes the shearing action of a machined sleeve to produce a leakproof joint. This type of fitting is primarily designed for high pressures and resistance to vibration, and is recommended for any rigid tubing other than annealed copper.

The Lenz fitting, illustrated at *D*, represents a fairly recent development, in which an O-ring seal is used in a recess and contacts the outer periphery of the tube. When the nut is tightened, pressure is applied through split tapered rings to lock the tube in place. Another fitting in which flaring is employed to secure the tubing is the Graf 90-degree elbow shown at *E*.

In cases where the tubing is secured by flaring, tools made especially for the purpose should be employed. The flare must not be too wide, and the two sealing surfaces must be free from defects. In making connections in systems of this type, the clamping nut and ring should be properly installed on the tube before the end is flared. When clamping nuts and rings are integral, the use of other fittings with them is not generally recommended, because tubes are often twisted as a result of the torque applied at the nut in tightening them. It is essential that tubes be flared and cut to the correct length in these installations, especially when connecting two points in a straight line.

The tubing used in most systems is soft annealed cold-drawn steel (S A E 1010), drawn to close tolerances in order to obtain accurate fits with the connections. Suitable equipment, either hand- or power-operated, is available for bending the tubing so as to use a minimum number of fittings. A radius of not less than three times the diameter of the tube should be used in such bends.

One of the principal advantages of this type of installation is the use of small-diameter transmission lines having the same capacities as larger pipe; moreover, the elimination of numerous fittings makes a neater, more economical system.

Tables 2 and 3 show the inside diameters of steel tube recommended for various working pressures in hydraulic systems. The data calculated was based on Barlow's formula for the strength of cylinders subjected to internal pressure, in which

$$t = \frac{DP}{2S}$$

where

t = wall thickness, in inches;
D = outside diameter, in inches;
P = pressure, in pounds per square inch; and
S = allowable tensile stress (taken as 12,000 pounds per square inch).

In oil hydraulic systems where pressures are over 1000 pounds per square inch and where pipe sizes are above 1 1/4 inches, socket-welded fit-

Table 2. Inside Diameters of Steel Tubes Recommended for Various Working Pressures

Pipe Size, Inches	Outside Diameter, Inches	Working Pressures, Pounds per Square Inch (Safety Factor, 5 to 1)									
		1000	2000	3000	4000	5000	6000	7000	8000	9000	10,000
1/4	0.54	0.50	0.45	0.41	0.37	0.32	0.27	0.23	0.18	0.14	0.09
1/2	0.84	0.77	0.70	0.65	0.56	0.49	0.42	0.36	0.28	0.21	0.14
3/4	1.05	0.96	0.88	0.79	0.70	0.61	0.53	0.44	0.35	0.27	0.18
1	1.315	1.20	1.10	0.99	0.88	0.77	0.67	0.55	0.44	0.33	0.22
1 1/4	1.66	1.52	1.38	1.25	1.11	0.97	0.84	0.69	0.56	0.42	0.28
1 1/2	1.9	1.74	1.58	1.43	1.28	1.11	0.95	0.79	0.64	0.48	0.32
2	2.38	2.18	1.98	1.78	1.49	1.39	1.19	1.00	0.80	0.60	0.41
2 1/2	2.88	2.64	2.40	2.16	1.92	1.68	1.44	1.20	0.96	0.72	0.49
3	3.5	3.21	2.92	2.63	2.34	2.05	1.75	1.46	1.17	0.88	0.59
3 1/2	4	3.67	3.34	3.00	2.67	2.34	2.00	1.68	1.34	1.01	0.68
4	4.5	4.13	3.75	3.38	3.00	2.70	2 1/4	1.88	1.50	1.13	0.75
4 1/2	5	4.59	4.17	3.75	3.34	2.93	2 1/2	2.10	1.68	1.27	0.85
5	5.56	5.10	4.64	4.17	3.72	3.25	2.78	2.33	1.87	1.40	0.94
6	6 5/8	6.08	5.53	4.97	4.43	3.88	3.31	2.78	2.23	1.68	1.125
7	7 5/8	6.99	6.38	5.72	5.09	4.46	3.81	3.19	2.56	1.93	1.30
8	8 5/8	7.81	7.19	6.47	5.76	5.03	4.31	3.61	2.90	2.18	1.47

tings and pipe with welded flanged connections are generally used. Elbows, T's, crosses, and couplings are commercially available, and a system is made up by slipping the ends of the pipe into sockets in the fittings and then welding.

Pipe is bent, where possible, to reduce the number of fittings required in a circuit, the larger sizes generally being bent hot after fitting them with sand, while the smaller sizes are handled cold on bending machines. Radii should never exceed five times the diameter of the pipe.

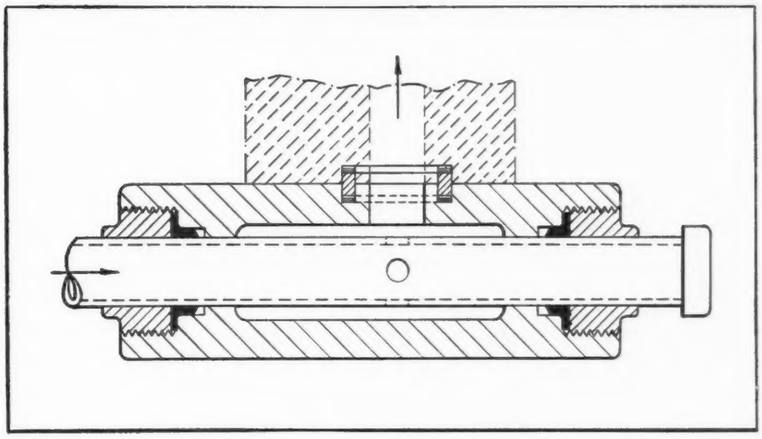


Fig. 4. A slip joint connection is used in hydraulic circuits where it is necessary to transfer fluid from a stationary member to one that moves

Flanges to which pipes are welded are usually bolted to various units in a hydraulic system, making allowance for stresses imposed by misalignment, relative movement of various members of the system, etc. Gaskets of the confined compression or O-ring type are used to seal these connections. In all cases, the pipe must be free from dirt, sand, or scale before installation, and it should never be forced into place in making the installation, since forcing may distort the valves or other components of the system.

The soldered tube joint illustrated in Fig. 3 is a simple form of connection occasionally used in applications where pressures are relatively low. Another interesting type of connection, a slip joint, is shown in Fig. 4. This type of joint is used in systems where it is necessary to transfer liquid from a stationary member of a circuit to a moving member.

In oil hydraulic systems, the careful selection and application of valves is as important as the proper choice of pipe and fittings, since the valves control the hydraulic power transmitted. Various types and combinations of valves are used to control the direction of flow, the volume, or the pressure of the liquid. The selection of a valve for any particular purpose depends upon the type of service in which it is to be used and the working pressure in the circuit.

Among the different valves used for controlling pressure are relief and safety valves and reducing, sequence, and back-pressure valves. Those that control the direction of flow include two-way, three-way, and four-way valves, which can be actuated mechanically, electrically, or hydraulically. Pilot valves are used to control the direction of flow of the liquid to other valves, such as check, shut-off, and stop valves.

Volume control is obtained by using throttle valves, flow controls, and metering devices in variable-delivery pump systems. One of the most common valves used in hydraulic circuits to start, stop, and sometimes to limit manually the flow of liquid is the gate valve, Fig. 5. In this type of valve, fluid flow is controlled by means of a gate A, which opens or closes the passage. The gate is raised or lowered by the action of a screw or by other mechanical means. The gate blocking the passage may be of a box wedge, a solid wedge, or of sectional construction. Very

Table 3. Inside Diameters of Threaded Steel Tubes Recommended for Working Pressures of 3000 and 6000 Pounds per Square Inch

Pipe Size, Inches	Outside Diameter, Inches	3000 Pounds per Square Inch			6000 Pounds per Square Inch		
		Wall Thickness, Inches	Inside Diameter, Inches	Area, Square Inches	Wall Thickness, Inches	Inside Diameter, Inches	Area, Square Inches
1/4	17/32	5/32	0.17	0.0227	.....	....	.....
3/8	21/32	5/32	0.35	0.103	.....	....	.....
1/2	27/32	3/16	0.46	0.167	1/4	0.34	0.091
3/4	1 1/16	3/16	0.68	0.363	5/16	0.43	0.154
1	1 5/16	3/16	0.94	0.695	11/32	0.63	0.322
1 1/4	1 5/8	1/4	1.13	1.020	3/8	0.88	0.610
1 1/2	1 7/8	5/16	1.26	1.250	13/32	1.07	0.915
2	2 3/8	3/8	1.63	2.100	7/16	1.50	1.670
2 1/2	2 7/8	1/2	1.88	2.770	9/16	1.75	2.440

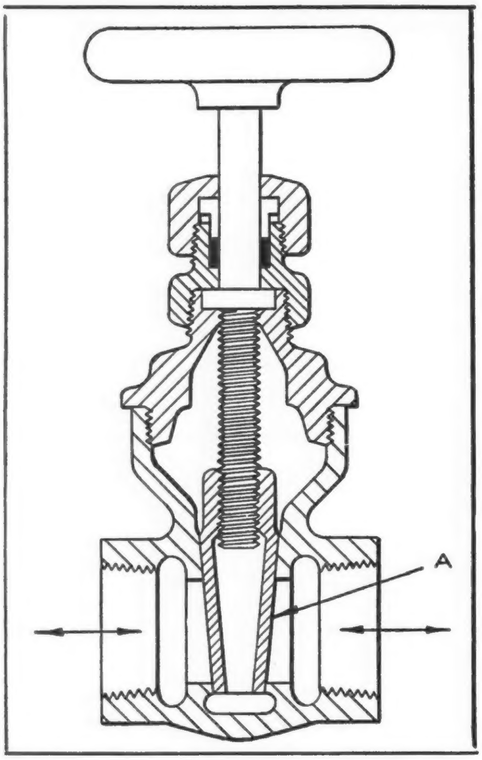
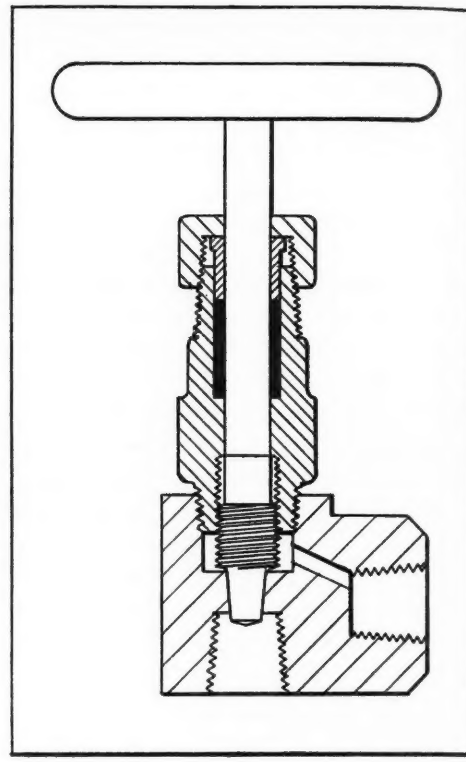


Fig. 5. (Left) A typical gate valve, used to start, stop, and sometimes to limit manually the flow of liquid in a circuit. Gate (A) is raised or lowered to open or close the passage

Fig. 6. (Right) An angle type of needle valve that has a long tapered point for gradually opening and closing the passage. This type of valve is used to restrict the volume of liquid flowing in a circuit



little resistance to flow of liquid is offered by this type of valve.

The needle valve, Fig. 6, restricts the volume of liquid flow in a circuit. Valves of this type are used for the manual readjustments occasionally required in regulating feed during the operation of machines, and also in gage circuits and cylinder cushioning circuits. As shown, a long, tapered point is employed in place of a gate to permit very gradual opening and closing of the passage. The needle valve illustrated in Fig. 7 has a replaceable valve point and seat.

A globe valve is shown in Fig. 8. This type of valve is similar in its action to the gate valve, but it utilizes a tapered plug in place of the gate. Some globe valves use a ball or a disk that fits a seat to close or open the passage. Globe valves are generally located in circuits where the passages are opened and closed often. Although these valves offer more resistance to the flow of

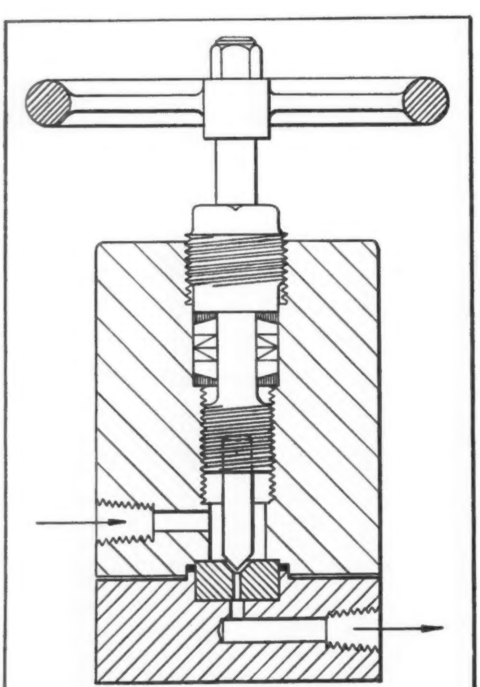
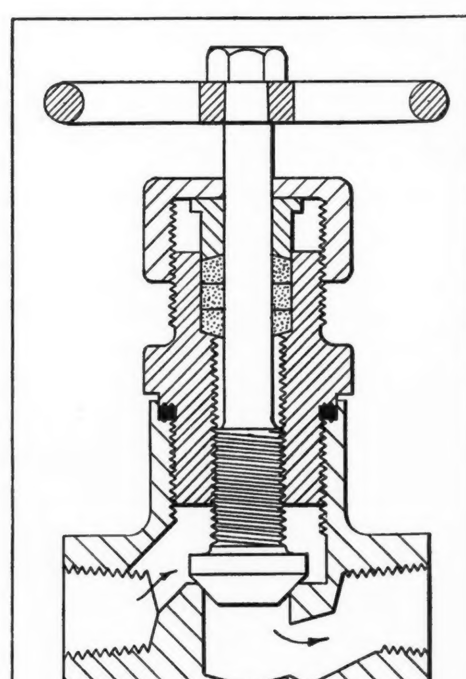


Fig. 7. (Left) Needle valve, similar in design to the one illustrated in Fig. 6, but having a replaceable point and seat

Fig. 8. (Right) Globe valves, used in circuits where passages are opened and closed often, have balls or disks that fit the valve seats to open or close the passage



liquid than gate valves do, they are opened and closed under pressure more easily when proper piping is provided.

In the installation of valves, considerable attention must be given to the accurate fitting of pipes, so as to reduce the strains imposed on a valve body by the connection. These strains cause one of the most common troubles that occur in the operation of valves—that is, the binding of the valve plunger. Often this problem can be eliminated by lapping or working the valve into position after the pipes have been fitted, although great care must be taken to remove all traces of lapping compound afterward.

Sometimes valves stick after being left under pressure for a long time without being moved. This is caused by the infiltration of fine solid particles into clearances between the moving members, the quantity of particles depending on the length of time the valve remains unmoved, and, of course, on the pressure differential.

Proper fitting of pipes is important, too, in the correction of external leakage, which may also be corrected by attention to packings or drains. Generally, internal leakage can only be reduced by the use of a new plunger. From the foregoing, it can be seen that the same care and attention given the installation of pipes in hydraulic systems must be provided when valves are being fitted into the circuit.

* * *

A.S.T.E. Announces Second Annual Scholarship Awards Contest

Five scholarships of $300 each to aid students in their fourth or fifth year who are taking subjects coming under the general category of "Tool Engineering," will be awarded by the American Society of Tool Engineers in 1952.

Five awards will be made, as in the previous year—four to students in the United States and one to a student in Canada. To be eligible, students must be taking one or more of such subjects as metal processing, tool design, plant layout, inspection, or advanced courses in manufacturing processes in institutions accredited in engineering by the Engineers Council for Professional Development. Final selection will be made by the National Education Committee of the Society on the basis of the student's own record, professional interests, work experience, personal need, and recommendations of faculty.

Applications for scholarships must be made not later than March 1, 1952. Detailed information and application blanks can be obtained from the American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

Melting Point of Vanadium Raised by Alloying with Titanium

Alloys of titanium and vanadium are being studied for extremely high-temperature application in jet aircraft and guided missiles, according to information given in a paper presented at the midwinter meeting of the American Society for Metals in Pittsburgh. The authors of the paper, H. K. Adenstedt, J. R. Pequingnot, and J. M. Raymer, all of Wright-Patterson Air Force Base, Dayton, Ohio, explained that their investigations represent a single phase of an extensive research program sponsored by the United States Air Force at the Materials Laboratory of the Wright-Patterson Air Development Center.

It was pointed out in the paper that high heat resistance is obtainable by alloying vanadium with titanium. Thus, the melting point of high purity vanadium has been raised experimentally from the previously established 3137 degrees F. to 3450 degrees F., an important differential in aerial warfare. The melting point of titanium is in the vicinity of 3300 degrees F.

For microscopic observations, small rectangular samples of the alloy were cut from normally cast ingots and severely cold-worked by compressing them 65 to 75 per cent between hardened steel blocks. The metallic sections then were homogenized in a vacuum furnace at 1700 to 1800 degrees F. for fifteen to twenty hours. After the drastic homogenizing, the specimens were again cold-worked and sealed in vacuum quartz tubes.

To establish equilibrium or molecular stabilization, the tubes and pieces were kept at temperatures varying from 1200 to 1600 degrees F. for 300 to 600 hours, after which the quartz tubes were broken. It was stated that at 1200 degrees F., equilibrium was very nearly approached, and the authors believed that at 1345 degrees F. or higher, equilibrium actually was obtained.

Surfaces for microscopic inspection were prepared by wet-grinding, using 600-grit silicon carbide paper, followed by electrolytic polishing.

* * *

New Method of Joining Rubber to Steel

A new method of joining silicone rubber to steel in a permanent bond that is said to be stronger than the rubber itself has been developed by the General Electric Co., Schenectady, N. Y. The thin, glue-like primer that forms the bond in such applications as shock mounting for engines withstands temperatures of from —85 degrees F. to 500 degrees F.

Large Tractor Gears—A

By GORDON SWARDENSKI
Manager, Planning and Tooling
Caterpillar Tractor Co.

METICULOUS quality control and high precision are just as essential in making heavy tractor gears as they are in manufacturing gears for passenger cars or machine tools. But because of the large size and mass of tractor gears, the manufacturing problems, when close quality control is necessary, are considerably more difficult than those encountered with smaller gears. The greater the mass of the gear, the greater its probable distortion in heat-treating and, therefore, the greater the difficulty in maintaining critical dimensions. The final drive gear for the D8 tractor, with its mating pinion, will be taken as a typical example of the gear manufacturing methods used at the Caterpillar Tractor Co., Peoria, Ill., to overcome these difficulties.

Both of these units are heavily loaded in service, and must be strong enough to withstand the frequent overloads common in tractor operations. This requires adherence to rigid dimensional specifications in order to assure correct mating of the teeth, minimum backlash, freedom from "end bearing," and quiet operation. In spite of the exacting requirements, tractor gears must be produced economically. That demands close coordination of the engineering, manufacturing, and metallurgical departments.

The final drive gear is made from a special steel similar to S A E 1042, while the pinion is a modified S A E 8622 steel. Steel analyses are checked both at the mill and by the company before acceptance. The outside diameter of the gear after heat-treatment is 26.154 inches, and the number of teeth, 62. The diametral pitch is 2.413 inches, the pressure angle is 20 degrees, and the pitch diameter, 25.694 inches. The circular pitch is 1.302 inches, the addendum 0.2302 inch, and the whole depth of tooth 0.913 inch.

The tooth form of this gear is a modified involute. The modification consists of a relief of 0.005 inch on each side of the tooth profile, produced before heat-treatment by gear-shaving. As may be seen in Fig. 2, the modification starts at 4.394 inches of travel off the base circle. Backlash on the pitch line is held within 0.006 to 0.010 inch. The permissible tooth error includes a total pitch line run-out of 0.010 inch, a circumferential lead of 0.004 inch, and tooth spacing within 0.002 inch.

The rough forging for the drive gear weighs 306 pounds. After being machined, the gear

Problem in Accurate Machining

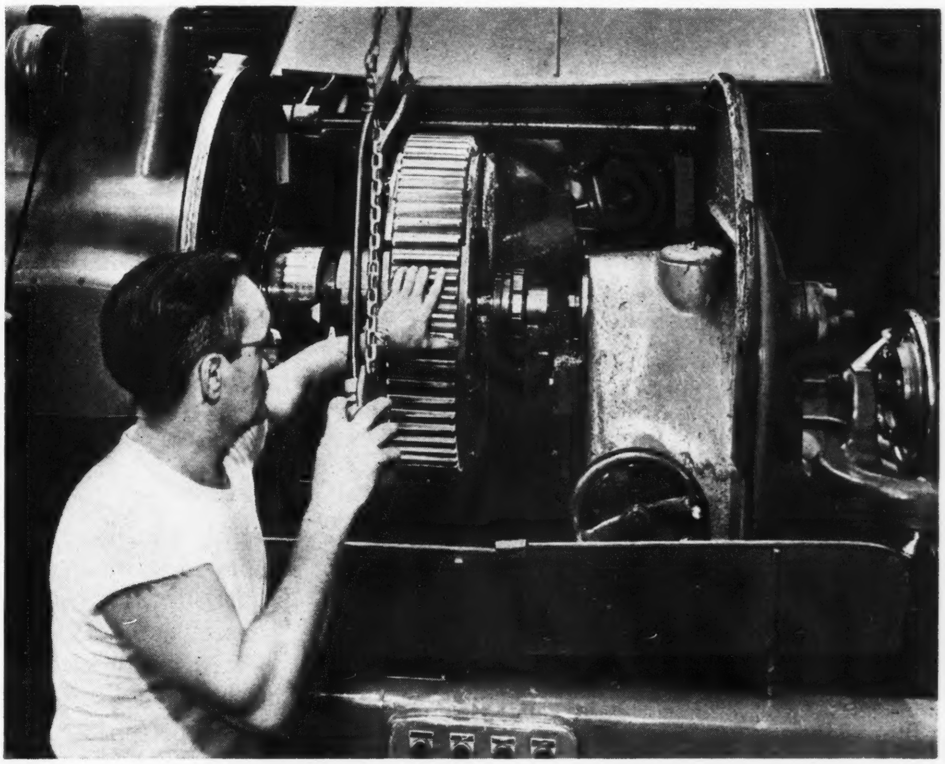


Fig. 1. "Red Ring" gear finisher used for crown-shaving drive gears (guard removed to show work)

weighs 202 pounds. Thus, 104 pounds of chips are removed from the forging. With this amount of machining, it is apparent that steel analyses and heat-treatment must be under very close control in order to predict accurately the amount of distortion that is likely to take place during heat-treatment.

Manufacture of the drive gear begins with rough blanks which are roll-forged, normalized, and then rough-turned and faced in Potter & Johnston automatics. As soon as a sufficient number of gears have been rough-turned, a sample is heat-treated to find the average distortion.

A Bullard 42-inch vertical turret lathe is used for finish-turning, facing, and boring. Since as much as 41 pounds of metal is removed in gear-cutting, this operation is done in two stages. First the teeth are rough-cut in a Gould & Eberhardt gear-cutter, two blanks being handled at one time. Semi-finish-hobbing is done in another Gould & Eberhardt machine, as shown in the heading illustration. This is followed by gear-shaving in a 36-inch "Red Ring" gear finisher (Fig. 1), made by the National Broach & Machine Co.

The practice of gear-shaving is an important

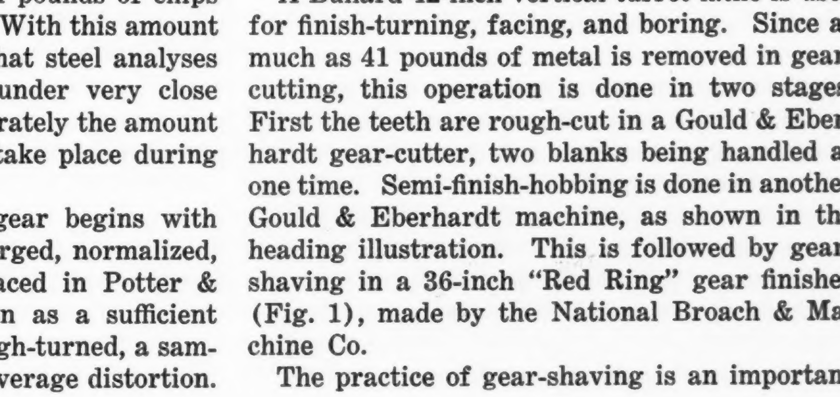
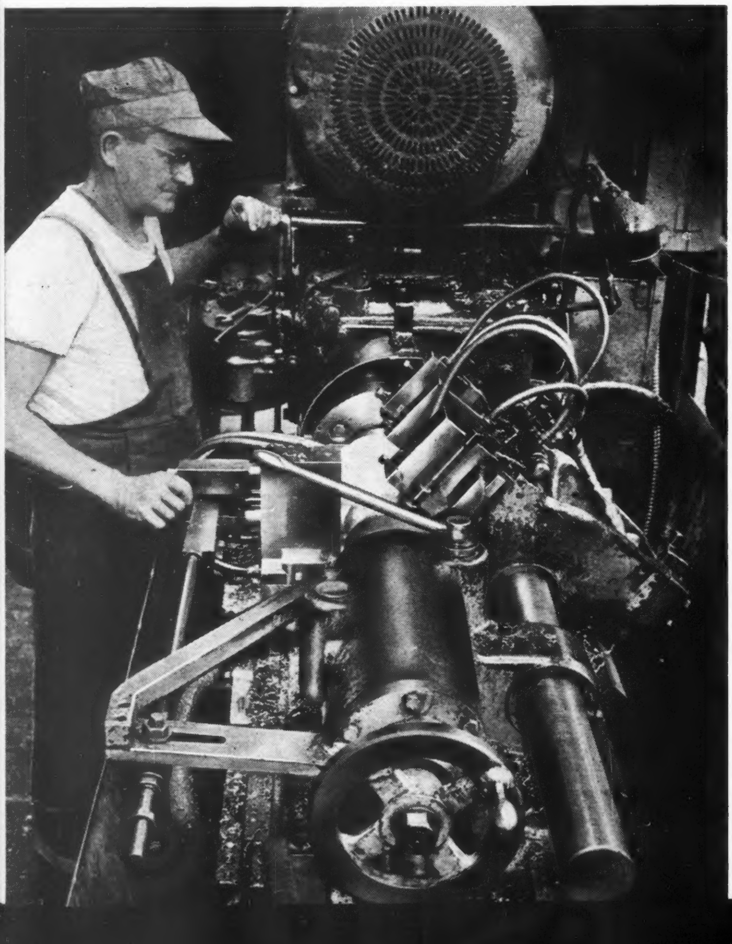


Fig. 2. Involute modification at the tip of a drive-gear tooth is produced in hobbing and corrected after heat-treatment by crown-shaving

Fig. 3. Two-station induction hardening machine for hardening drive-gear teeth. The gear is given a carefully timed cycle of heating, soaking, and quenching

factor in the dimensional control of these gears, and also in the economy of their production. The gears in question, together with other transmission and timing gears, are shaved after hobbing and before heat-treatment. This practice compensates for the distortion which usually occurs in heat-treatment and which has been carefully charted from long experience. Shaving not only controls the dimensional characteristics of the gears, correcting gear-cutting errors and producing smooth quiet-running tooth surfaces, but also eliminates the final grinding and lapping operations that were essential before shaving was adopted.



The teeth of the drive gear are crown-shaved—that is, they are provided with the elliptoid form to prevent "end bearing," particularly under overloads, which cause case distortion, shaft deflection, and dangerous concentrations of stress at the ends of the teeth. Both sides of the teeth are given a 0.004-inch crown located in the middle third of the tooth face. Crown tolerance is 0.002 inch.

Following the machining operations, the gear is washed, deburred, preheated, and sent to the two-station Tocco induction hardening machine shown in Fig. 3. After a carefully controlled and timed cycle of heating, and a short soak, the work is jet-quenched. This is followed by tempering in an adjacent furnace. The work is next inspected by the Magnaflux method and then shot-blasted in a cabinet type machine. The effectiveness of the heat-treatment is checked by testing for hardness. Bolt-holes are now drilled and chamfered, after which the flange is finish-

Fig. 4. The pinions that engage with the drive gears are formed, turned, and faced in Fay automatic lathes, using cemented-carbide tools

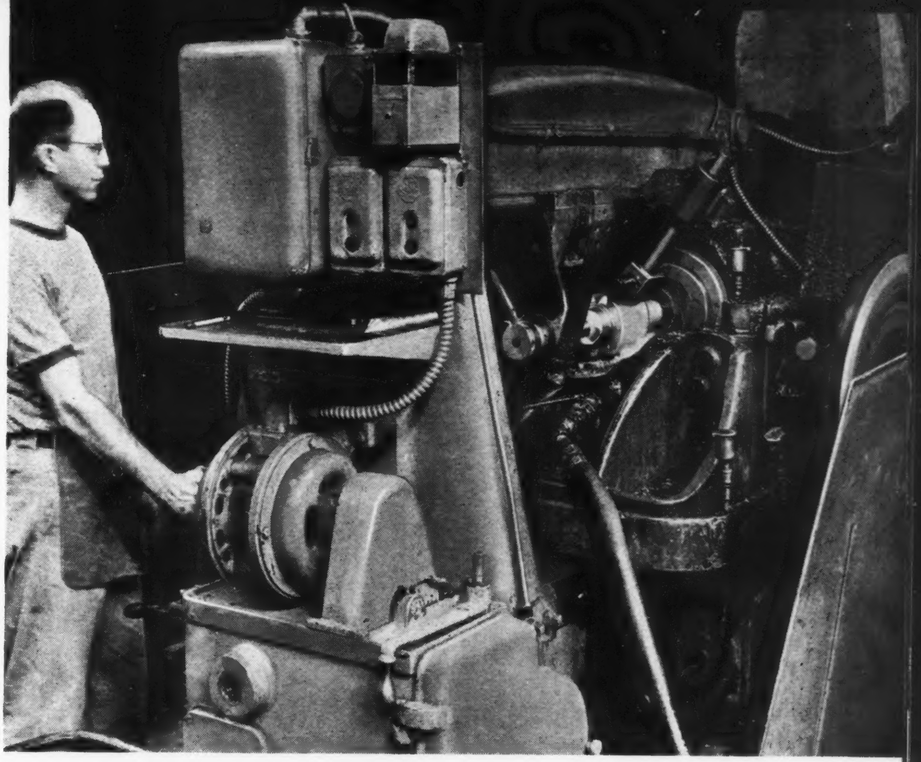


Fig. 5. The teeth in the pinion are cut in two operations—rough-hobbing and semi-finish-hobbing—in Barber-Colman gear-cutting machines

bored and finish-faced in a Bullard 36-inch vertical turret lathe to insure squareness and concentricity of these mounting surfaces relative to the pitch diameter of the finished gear.

Forgings for the pinions are annealed and shot-blasted in a Tumblast machine. After being milled to length and centered, the forgings are formed, turned, and faced with carbide-tipped tools in Fay automatic lathes, Fig. 4. Next the teeth are rough- and semi-finish-hobbed in Barber-Colman hobbing machines, Fig. 5. The spline on the tapered end is then cut in a Barber-Colman machine, and the threaded end is machined in a Lees-Bradner thread miller. Finally, a "Red Ring" gear finisher is used to straight-shave the teeth as seen in Fig. 6.

After being deburred and washed, the gears are carburized, hardened, degreased, and tempered. Hardness testing follows shot-peening in an American Tablast machine.

The outside diameter of the drive pinion after heat-treatment is 5.683 inches, and the number of teeth, 11. The diametral pitch is 2.413 inches, and the pressure angle is 20 degrees. The pitch diameter is 4.559 inches, the circular pitch, 1.302 inches, the addendum, 0.562 inch, and the whole depth of tooth, 0.899 inch. The tooth form is standard involute, straight shaved. Backlash is held to within 0.007 to 0.009 inch. The permissible tooth error is held closer than on the drive gear, since the pitch line run-out is maintained within 0.005 inch, circumferential lead is held within 0.0025 inch, and the tooth spacing within 0.002 inch.

Tractor gears are produced in this plant in relatively large numbers at minimum cost by paying careful attention to every step of manufacture—from the selection of the steel to the final inspection.

* * *

The battleship "Texas," commissioned in 1893, was one of the first such vessels to use nickel-steel armor plate. Since that time nickel steel has come to be considered the standard material for all types of armor plate.

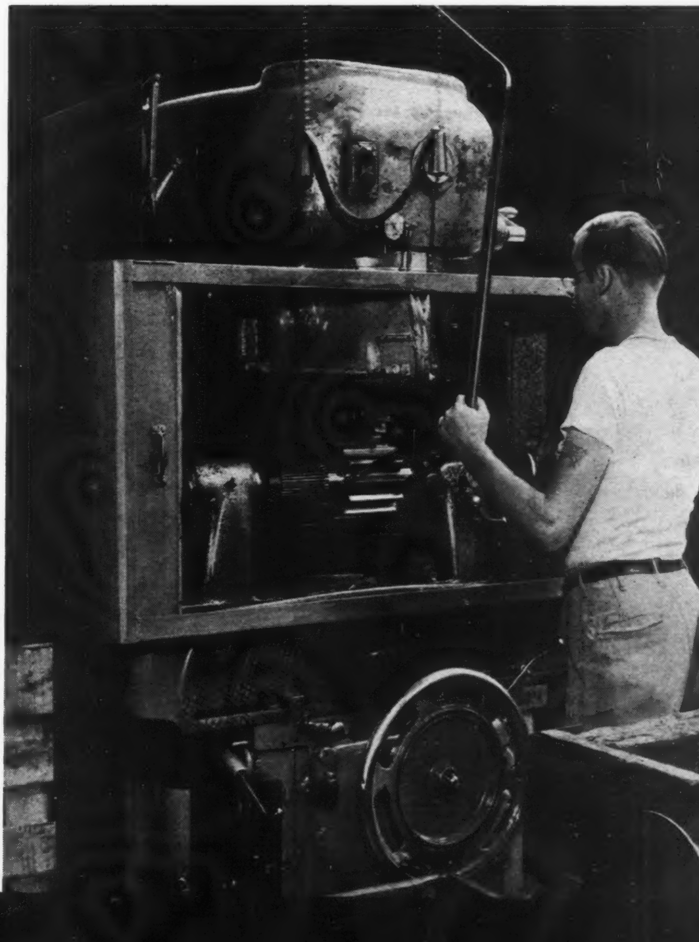
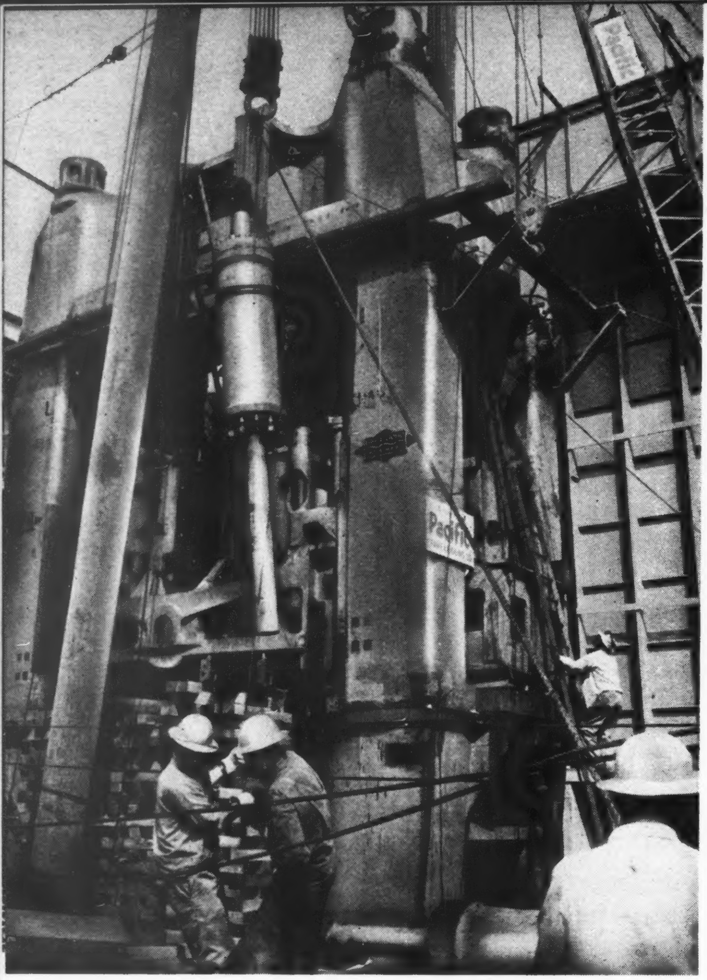


Fig. 6. After cutting the spline on the tapered end and thread milling the other end, the pinion is straight-shaved in a "Red Ring" gear finisher

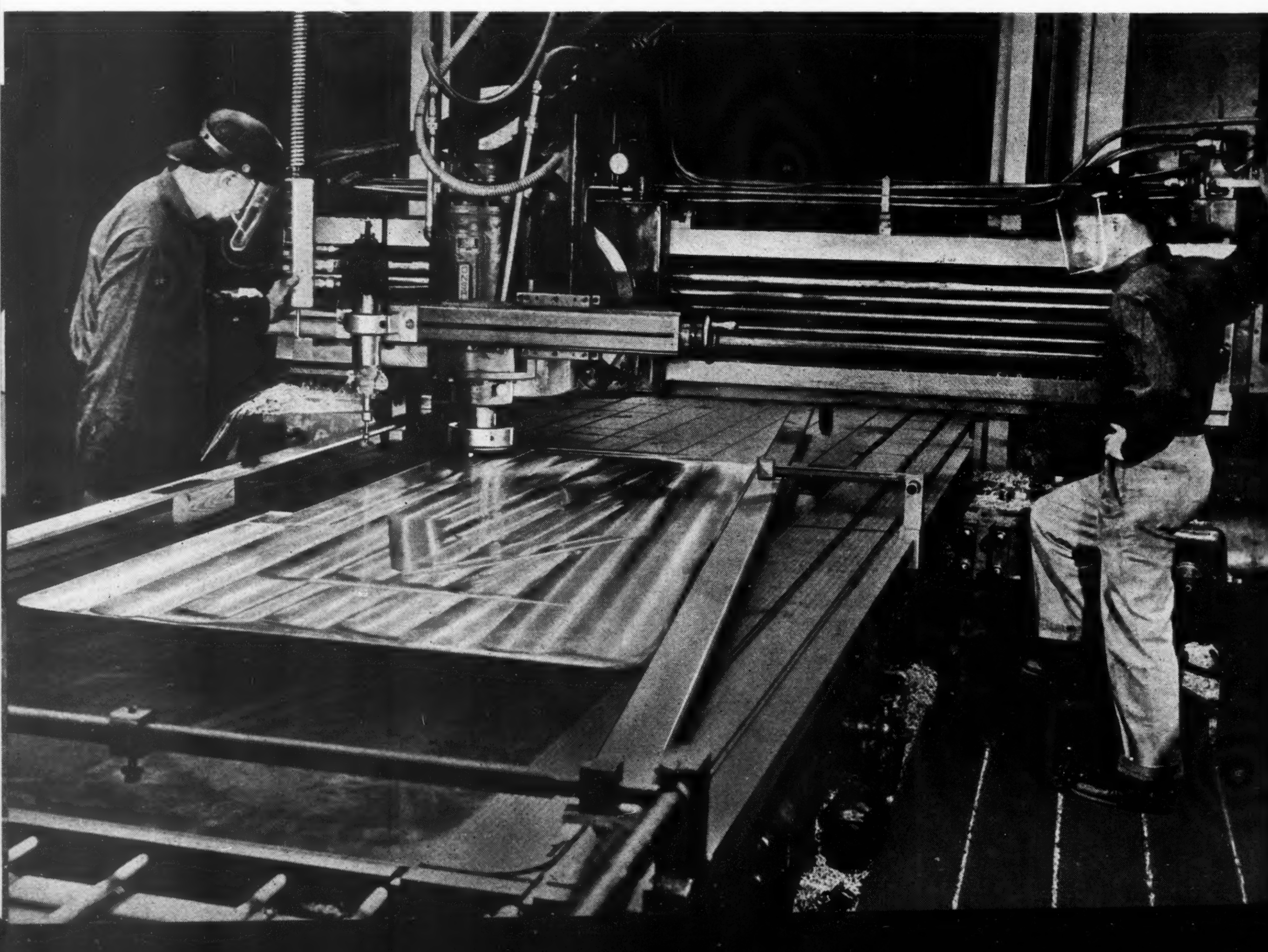
In Shops Around

Operations of Dramatic Interest are Constantly Performed in Shops in Various Branches of the Metal-Work-



Largest hydraulic press in the aircraft industry being assembled at Lockheed Aircraft Corporation. The 8000-ton Birdsboro press is as high as a four-story building and weighs over 2,370,000 pounds. Walls and roof will be built around press

Skin milling of an aircraft part on a planer equipped with an Onsrud high-speed milling head that is tracer-controlled by a Turchan follower attachment. A template and tracer (left) guides the hydraulically operated cutting tool. Close tolerances are maintained and considerable savings are effected



the Country

ing Industry. These Pages Show Each Month a Selection of Such Operations in Machine Shops from Coast to Coast

A Sunnen honing machine is employed to finish the bore of a large brass gear in the Mount Vernon, N. Y., plant of North American Philips Co., Inc. The gear is one of many accurate parts required for the wide-range goniometer, an X-ray diffraction tool

A 50-ton steel weldment for the bed of a huge Bliss stamping press being cut on a horizontal milling and boring machine—one of the heaviest and most powerful machines of its kind ever built by Ingersoll. The machine weighs nearly 400,000 pounds, and has a 24-inch square ram and 40-foot horizontal housing travel

Fig. 1. Part of the production line for assembling alternating-current welding machines. Purchased parts and manufactured sub-assemblies are stocked at point of use

Interesting Welding
Lincoln Electric's

More Efficient Manufacture of Welding Machines and Electrodes is the Result of a Flexible Plant

A PRIMARY objective of the Lincoln Electric Co. in building its impressive new plant in Euclid (Cleveland), Ohio, was to provide for more efficient manufacture of welding machines and electrodes by reducing indirect labor costs. As a result, many of these costs have been eliminated, and other benefits have been realized. Raw materials, purchased parts, and manufactured sub-assemblies are stored at the exact points along the assembly lines where they will be needed, thus producing, in effect, a factory within a stock-room.

The huge windowless plant is situated on a 65-acre site and provides approximately 860,000 square feet of floor space. While the company's old plant could handle a 40 per cent increase in production, many cost-cutting ideas could only be put into practice in a new building with unobstructed floors and substantial overhead clearance. All of the seven additional acres of floor space now available has been utilized for more economical material handling.

Along the north wall, on the inside of the building, is an unloading dock for trucks and freight cars that permits materials and parts to be delivered almost at the exact spot needed. The various assembly lines extend straight across the building from the unloading dock to a storage and shipping platform along the south wall. Incoming materials and sub-assemblies are handled by nine overhead cranes, all capable of traveling the entire length of the unloading dock and down between any two adjacent production lines. Stock can be piled as high as 17 feet, since there is a 23-foot clearance under the roof trusses. This method of overhead handling saves approximately 20 per cent in floor space, and fork-lift trucks are needed only on the storage and shipping platform.

In the old plant, the cost of moving materials to various locations amounted to 14 per cent of the direct labor charges. By having the mate-

Fig. 2. Parts can be diverted from the apron type conveyor at any desired working station by means of an automatic, air-operated pick-off device

Operations Seen in New Plant

Lay-Out, by Means of which the Indirect Labor Costs have been Reduced to a Minimum

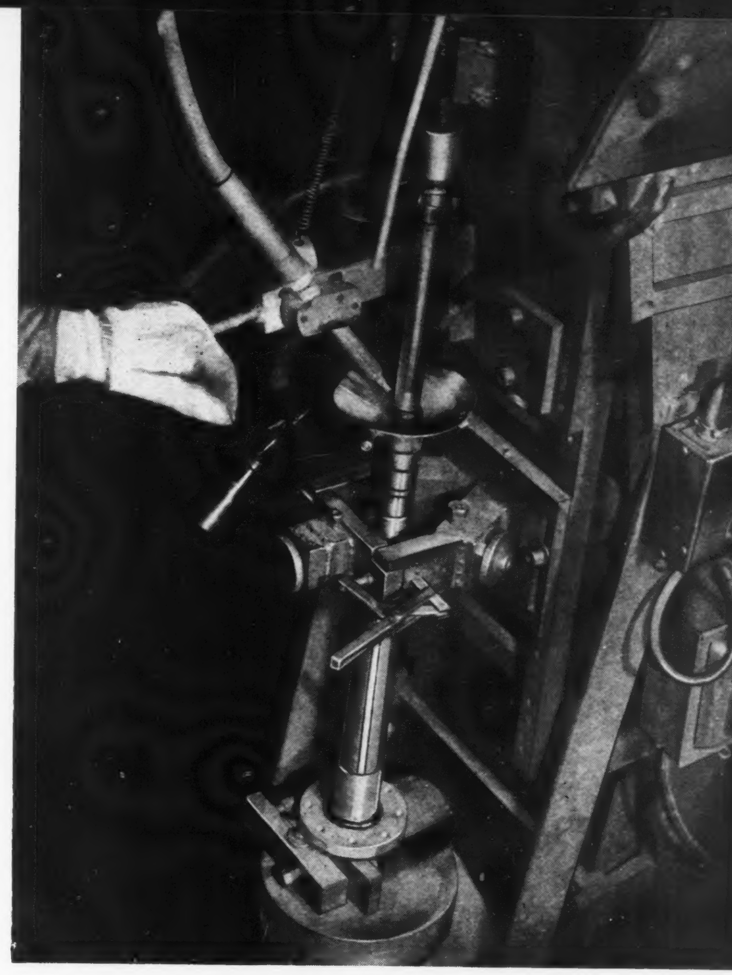


Fig. 3. By welding a slender exciter extension to the armature shaft, 25 pounds of steel were saved per shaft, and, in addition, the machining time was greatly reduced

rials and parts stored directly at the machines or assembly points, they are never handled twice in the same form. Set-up costs for changing machinery over to manufacture a different part amounted to 6 per cent of the direct labor charges in the old plant because of the lack of space for installing additional machines or for storing parts.

With everything stored within marked spaces on the floor at the point of use, each worker can see when he is running low on some part or material. The cost of paper work and supervision needed to keep inventories is thereby eliminated. This visual method of inventory was tried in the old plant, with the result that thirty-four persons were transferred to productive work.

Executive, sales, and factory offices are all centrally located in a two-story building that bisects the plant. The floor space on one side of this building is devoted to the manufacture of welding machines, while the opposite half of the plant makes electrodes. The only pedestrian entrance—used by executives, as well as by the office force and factory workers—is an underpass from an entry building to the offices and service corridor. This service corridor, which extends the full length of the plant, below the factory floor, contains the locker rooms, generators, and other services, and keeps the pedestrian traffic off the production floor. The flexibility of the plant layout makes it readily adaptable to the changes that are inevitable in any progressive manufacturing operation.

Typical of the various production lines is the one employed for assembling alternating-current welders, which is shown in Fig. 1. This view shows the variety of purchased items and parts manufactured on other lines that are stocked on the factory floor directly at the point of use. At this section of the assembly line, miscellaneous sub-assemblies, such as relay panels, are welded as required. The apron type conveyors which

Fig. 4. Copper chips from commutator turning operations are "welded" to a steel strip, producing a hard material that is used for electrode contact areas

Fig. 5. Armature-shaft couplings are now made at almost one-fourth the previous cost by building up a 3/16-inch thick bead on one face

run along each row of vertical columns were made by the Lincoln Electric Co. They are adjustable as to height, and are provided with variable-speed drives.

Automatic, air-operated pick-off devices, such as the one seen in Fig. 2, are provided at various working stations along the assembly lines. The actuating arm projects a pre-set distance over the apron type conveyor, and is contacted by certain work-pieces or sub-assemblies that are being transported. This causes the device to push the parts on a gravity roller conveyor leading to the work-station. Previous operators can bypass or deliver parts to any desired station by locating them properly on the conveyor. Because of the length of the standard direct-current welder assembly line—which permits adequate stocking of various parts—five different models can be made on one line.

A considerable saving in steel and machining costs has been realized by employing a new method of manufacturing motor-generator shafts. Previously, one end of the 3 1/8-inch diameter bar had to be turned down to less than 1 inch to form the exciter shaft. Now, by welding a 1 1/8-inch diameter extension to one end of a shorter shaft, 25 pounds of steel are saved per shaft and much less time is required for machining.

The exciter extension is joined to the shaft by

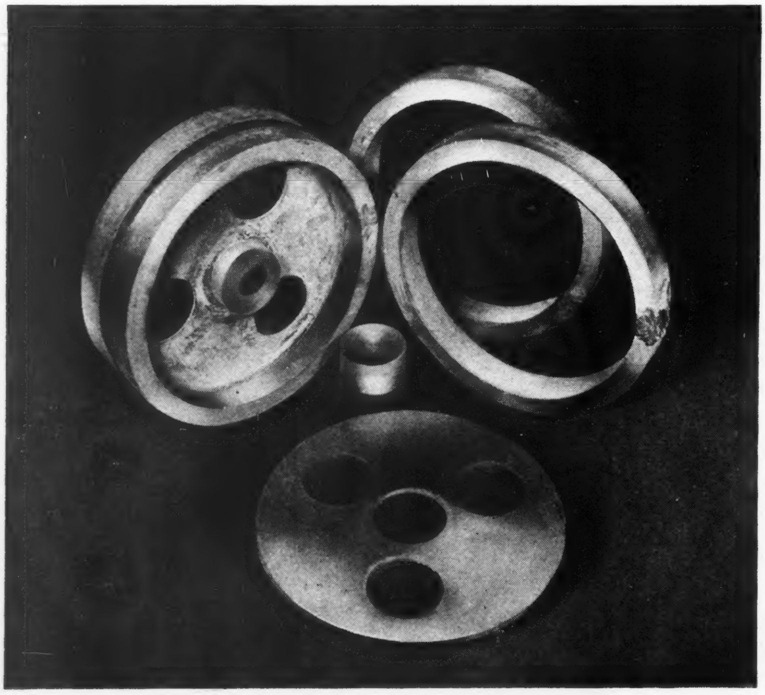


Fig. 6. Component parts and assembly of a welded flywheel. The two rims are roll-formed, while the punched disc fits between the rims and over the hub

Fig. 7. Semi-automatic, hidden-arc welding is employed to weld the flywheel components (Fig. 6). A 3/32-inch diameter electrode wire and a welding current of 325 amperes are used

means of a Lincoln semi-automatic, hidden-arc welding machine, Fig. 3. One end of the extension is chamfered to form a V-groove when fitted into a center hole in one end of the armature shaft. With the work-pieces held vertically and rotated at 7 R.P.M., a 5/64-inch diameter electrode wire is fed into the V-groove at an angle of 30 degrees with the shaft. A cup-shaped piece retains the granular flux around the weld area, and a current of 400 amperes is employed. Two passes are made to insure complete penetration and sufficient build-up to permit machining of the weld. After welding, the shaft assembly is straightened.

Regular hand-welding would be uneconomical for this particular application because of the amount of scarfing required to secure adequate penetration and the need for a large number of beads to fill the groove. Another advantage of the improved method of manufacture is that the shorter shaft can be machined prior to being welded to the extension, and deeper cuts can be made at higher speeds and feeds because the shaft is more rigid. In this way, rough-machining time has been reduced approximately 60 per cent, and finishing cuts 40 per cent.

An important money-saving development effected by the company is the use of copper chips salvaged from commutator turning operations to make a new material called "Lincalloy." The copper chips are mixed with steel by a unique patented process in producing the new material. This material is used as contact areas in electrode-holders, ground clamps, and automatic welding-head jaws. It replaces a critically short, precipitation-hardening copper alloy, and gives improved performance due to greater hardness.

The automatic hidden-arc welding process is used to make the mechanical solution of copper and steel, the arc being completely covered by granular flux. The scrap copper chips are spread on a narrow strip of steel, and a mild steel arc-welding wire, 5/32 or 3/16 inch in diameter, is traversed along the sheet at the rate of 24 inches per minute, as seen in Fig. 4. This causes the

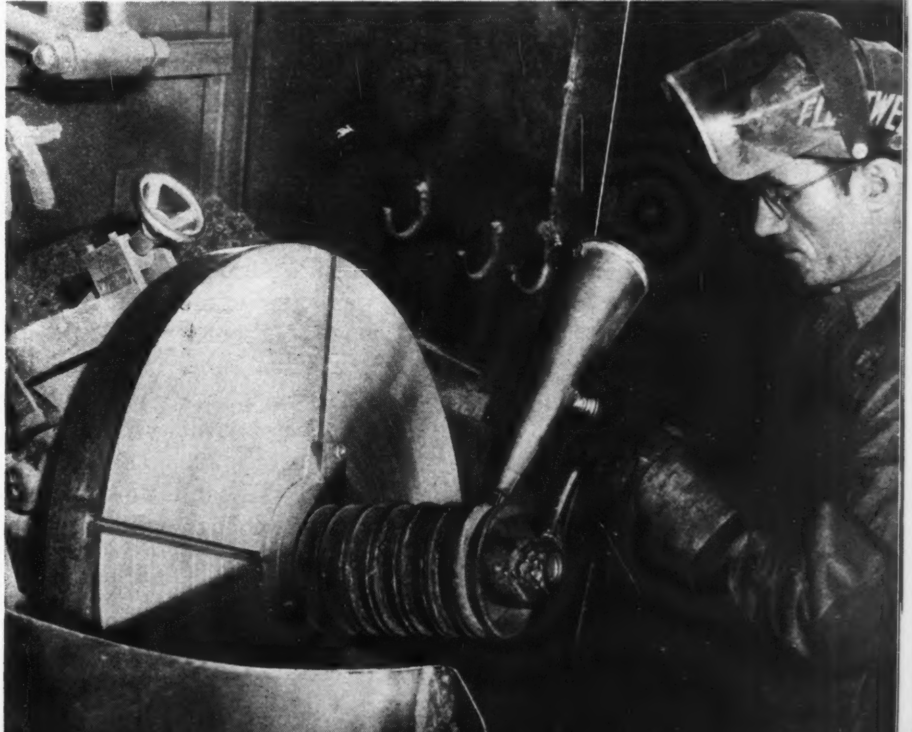


Fig. 8. Inverted-flange commutator caps are made by welding together two press-formed steel parts—a cone and a cup. The welding rate is 50 inches per minute

copper to melt and to become mixed with the molten steel in the weld crater.

Another unusual application of welding in this plant is in the manufacture of couplings for the armature shafts on gasoline-engine powered welders. The couplings were previously sawed from bar stock, 5 1/4 inches in diameter, to form blanks 1 1/4 inches thick. These blanks then had to be machined to produce couplings 13/16 inch thick with a 3/16-inch bead on one face.

By present methods, the couplings are punched to the required diameter from 13/16-inch thick steel plates, and the 3/16-inch bead is built up on one face by semi-automatic hidden-arc welding, as illustrated in Fig. 5. In this case, again, granular flux is employed, and 3/32-inch diameter steel welding wire is used. The work is mounted on a turntable, and welding is done at the rate of 10 inches per minute.

With the previous method, each coupling cost 38.3 cents. Now, they can be produced for 10.3 cents each, which represents a saving of 10 cents on material alone and 18 cents on the manufacturing costs.

Flywheels produced for a special welding machine are unusual in that they are of welded construction. This type of flywheel was selected because of design requirements, space limitations, availability of material, and the fact that it could be produced at relatively low cost.

Each flywheel, Fig. 6, requires two rims that are roll-formed from flat steel plates 1 1/8 inches thick, 2 inches wide, and 45 5/8 inches long. After the rolling operation, each plate forms a cylinder 15 7/8 inches in diameter with an air gap 1/2 inch wide between its ends that is filled in by welding. A flat steel disc, 15 1/2 inches in diameter by 3/8 inch thick, fits between the two rims and over a steel hub, 3 5/8 inches in diameter by 3 3/8 inches wide. The assembled parts are joined by semi-automatic, hidden-arc welding, as seen in Fig. 7. A 3/32-inch diameter electrode wire and granular flux are employed, using a welding current of 325 amperes. The welding is performed at the rate of 40 inches per minute.

Another example of the widespread use of welding in the manufacture of welding machines is illustrated in Fig. 8. Here a new design of inverted-flange commutator cap is being made by welding together two press-formed steel parts —a cone and a cup. No edge preparation is required for this operation, and the parts are welded with a 3/32-inch diameter electrode at the rate of 50 inches per minute, using 300 ampere current. At assembly, two of the caps are bolted together to hold the commutator bars, the cone part of the caps fitting into dovetail slots in the ends of the bars.

Navy Machine Tools Available to Defense Contractors

Approximately 10,000 machine tools—the last of a "moth-ball" stock of 47,000 which the Navy built up from World War II surpluses—are being made ready for delivery to Army and Air Force contractors. Vice Admiral C. W. Fox, Chief of Naval Material, has announced the planned program. He said that the "moth-ball" machines have been as important to the present defense program in their own way as the "moth-ball" fleet.

At the beginning of the Korean conflict, the Navy had acquired and put in good repair 40,000 machine tools and other production equipment. In the seventeen months since then, 7000 items, mostly related production equipment, have been acquired. In the same period, more than 15,000 machine tools were shipped to defense contractors who needed the scarce items.

Approximately 5000 of the Navy machine tools have been turned over to the Army and Air Force for distribution to their defense contractors, and another 16,000 are in use or are being shipped to Navy contractors working on joint contracts of the Navy Bureau of Aeronautics and the Air Force.

Admiral Fox said the Navy's post-World War II program of "moth-balling" against possible mobilization has been most successful in helping all the armed services during this critical period, when new machine tools have not been available in the volume required for the defense effort. He also stated that defense contractors should apply directly to contracting agencies to obtain tools being released from the Navy stock.

* * *

Manual on Preserving and Packing Military Supplies

The Department of Defense has announced publication of a joint "Manual on Preservation, Packaging, and Packing Military Supplies." The manual is a joint effort by the Departments of the Army, Navy, and Air Force, and is based to a large extent on a former Navy publication.

Copies of the publication are available to interested industrial firms from the Government Printing Office, Superintendent of Documents, Washington 25, D. C. Requests should include the full name of the manual and make reference to one of the following designations: Army Publication TM 38-230, or Navy Publication NAVEXOS P-938, or Air Force Publication AFM 71-1.

Rapid Milling of Cam Surfaces on Railroad Steam Couplings

THE speed of milling cam locking surfaces on flexible steam-tight couplings manufactured by the Vapor Heating Corporation, Chicago, Ill., has been more than doubled by the use of the special Cincinnati duplex eccentric milling machine seen in the heading illustration. The cast malleable-iron couplings, Fig. 1, carry steam from one railroad car to another, and are used in other applications where a safe, easily disconnected, flexible connection is necessary for transferring high-pressure steam.

Each coupling half has an upper and a lower cam locking surface which must be accurately formed and precisely located with respect to each other. In all subsequent machining operations, the castings are located from these form-milled surfaces.

The double-end eccentric milling machine is equipped with a four-station automatic indexing table. One station is used for unloading and reloading while castings clamped at two other stations are being machined. The remaining station, at the rear of the machine, is idle.

A previously machined concave gasket seat and a cast arm on each steam coupling serve as locating surfaces, and the parts are clamped by hand. The heads on which the form milling cut-

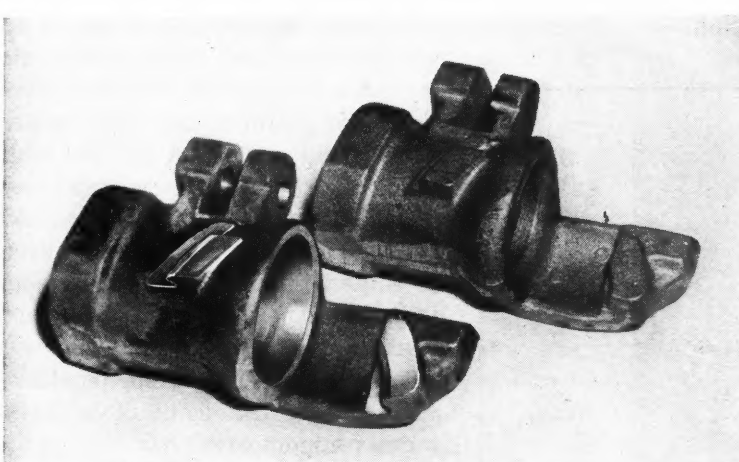


Fig. 1. The upper and lower cam locking surfaces on cast malleable-iron steam couplings are form-milled on the duplex eccentric milling machine seen in the heading illustration

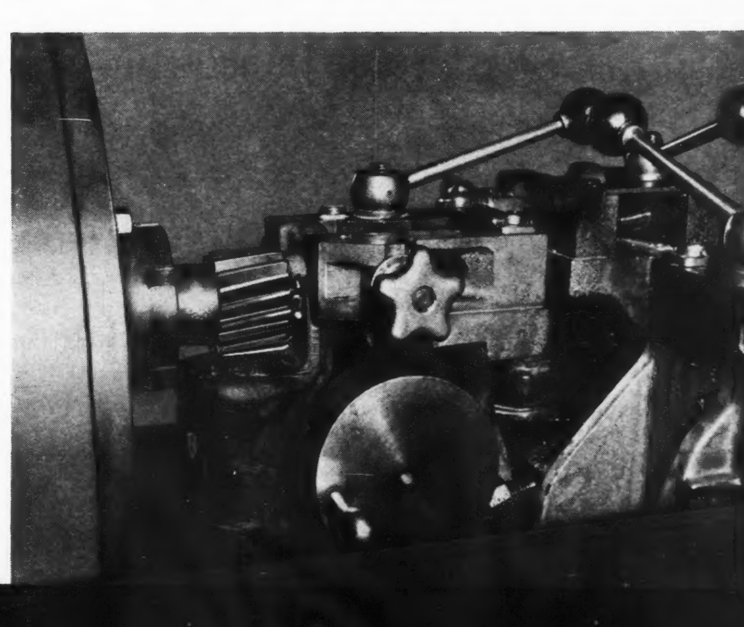


Fig. 2. Close-up view showing one of the two form cutters used on the eccentric milling machine. The heads on which the cutters are mounted rotate to generate the desired radii

ters are eccentrically mounted are fed hydraulically toward and away from the work-pieces, and rotated to generate the desired radii on the cam locking surfaces. Rotation of the heads is reversed by means of limit switches when the cuts have been completed.

The form milling cutters, one of which can be seen in the close-up view, Fig. 2, rotate at a cutting speed of 60 feet per minute, and are fed 3 inches per minute during the cutting cycle. The depth of cut varies from 1/16 to 3/16 inch, and a production of eighty steam couplings per hour is obtained.

* * *

Air Force Awards Atomic-Engine Contract to Pratt & Whitney

An Air Force contract for work on an atomic aircraft engine has been awarded to the Pratt & Whitney Aircraft Division of the United Aircraft Corporation. The U. S. Atomic Energy Commission is cooperating in the nuclear energy phase of this work.

The research department of the United Aircraft Corporation participated in the original post-war exploration of the possibilities of utilizing atomic power for aircraft, known as the NEPA project, which was sponsored by the Air Force and the Atomic Energy Commission.

Feed Nozzles for Arc-Welders "Wearproofed" with Carboloy

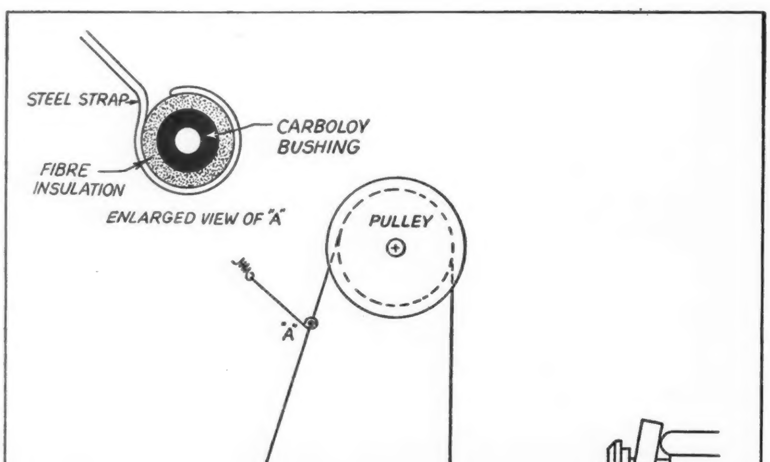
By inserting a Carboloy cemented-carbide bushing inside the conventional feed-nozzle tip for automatic arc-welding, the General Electric Co. has increased the life of the tips as much as twenty times at its Fort Wayne Works. In addition to solving the wear problem, the cemented-carbide bushings are said to reduce the burning effect.

In one case where the coiled electrode wire was especially abrasive, brass nozzles had to be replaced six to eight times a week. Nozzles protected by cemented carbide, as shown in the enlarged view of nozzle *C* in the accompanying illustration, are giving a service life of three months and more. On other operations where nozzle life previously did not exceed three weeks, the carbide nozzles are now lasting as long as twelve months.

Another advantage, in addition to increased nozzle life, is the fact that a more uniform narrow weld can now be maintained, since accurate guiding of the wire, which was formerly difficult once wear had developed, is no longer a problem. As a result of these advantages, the use of carbide-equipped nozzle tips has been made standard on twenty automatic arc-welding machines.

Improvements have been made by using cemented carbide at two other points, in order to further reduce "down" time and maintenance cost on arc-welding equipment. A carbide bushing (as shown in the enlarged view of *A*), placed inside the fiber guide that keeps the electrode wire from riding off the overhead pulley, eliminates any possible danger of short circuits resulting from the wire wearing through the fiber insulation and coming into contact with the metal support arm.

The other application of cemented carbide is in the guide block *B* which locks the electrode wire in position against the conical feed-rolls. When wear occurs at this point, positive feeding is impaired. To eliminate this condition, the guide block is tipped with a standard Carboloy cemented-carbide blank. The face of the blank is ground to provide a slight radius, as shown in the enlarged view of *B*.



Diagrams showing methods of applying cemented carbide bushings, facings, and inserts to automatic arc-welding machines

"Iron Hands" Make Press Operation Safer and Increase Production

PRESSES employed to draw the oven linings for electric ranges made by Hotpoint, Inc., Chicago, Ill., have been equipped with "Iron Hands" to permit automatic unloading. As a result, safety conditions have been greatly improved and production of the sheet-steel stampings has been increased. The self-contained "robot" arms, built by the Sahlin Engineering Co., are mounted on the press frame at the rear of the machine, as may be seen in the heading illustration.

At the completion of the drawing operation, as soon as the ram has moved upward far enough to permit removal of the work, the jaw of the automatic unloader swings into the die area and firmly grips an edge of the stamping. The "Iron Hand" then automatically lifts the part out of the die, swings it out of the press, and drops it on a conveyor. Following this, components of the mechanism return to their original positions, ready to repeat the cycle on the next stroke of the press.

Compressed air from the shop lines is used as the actuating medium, and the "Iron Hands" are electrically controlled. If the jaws do not withdraw from the die area—due to an interruption in air pressure, or for any other reason—the press ram is automatically stopped in its downward stroke by a safety limit switch.

Since the "Iron Hand" does not depend on the press for actuation, it can be set to remove the stamping at any moment during the upward stroke of the press ram. Also, since it can be arranged to lift the work vertically out of the die, the need for spring- or air-actuated lift-out pads in the die is eliminated.

In the first operation on the oven linings, a 250-ton Clearing press, seen in Fig. 1, draws embossments on the flat sheets to serve as wire-rack supports on the walls of the electric oven. The blanks, of cold-rolled, deep-drawing steel—64 inches long by 19 inches wide by 0.037 inch thick—are loaded manually into the die. This press, as well as others in the same production line, has a stroke of 14 inches and operates at a rate of seventeen strokes per minute.

The "Iron Hand" on this press, automatically unloads the drawn sheet, turns it over so that it is right side up for the next operation, and drops it on a gravity roll conveyor, as seen in Fig. 1,

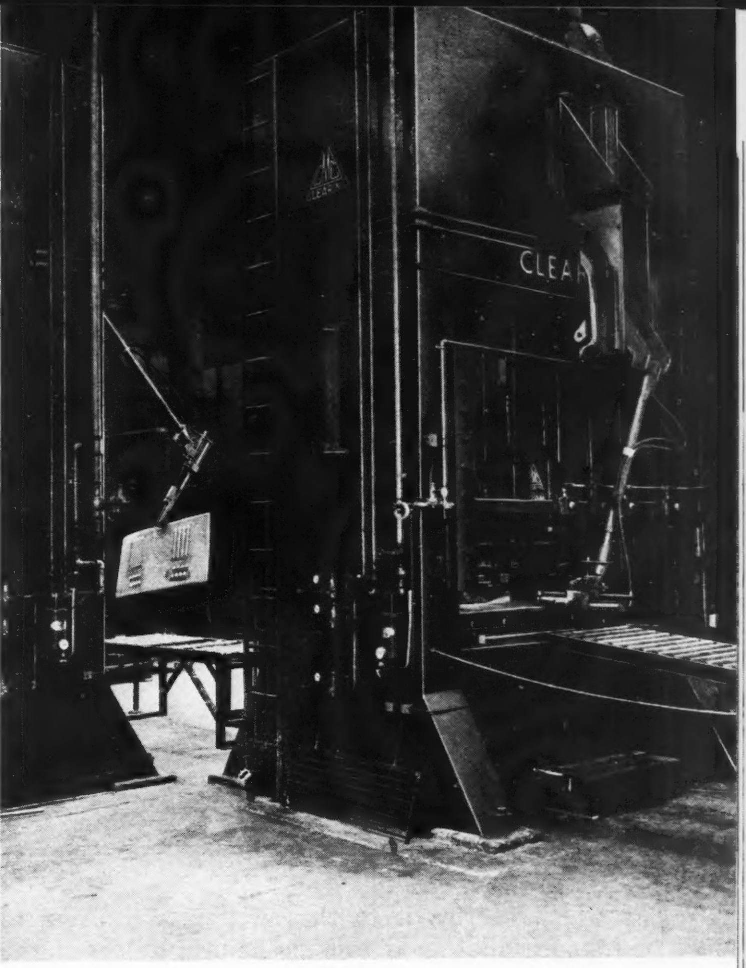
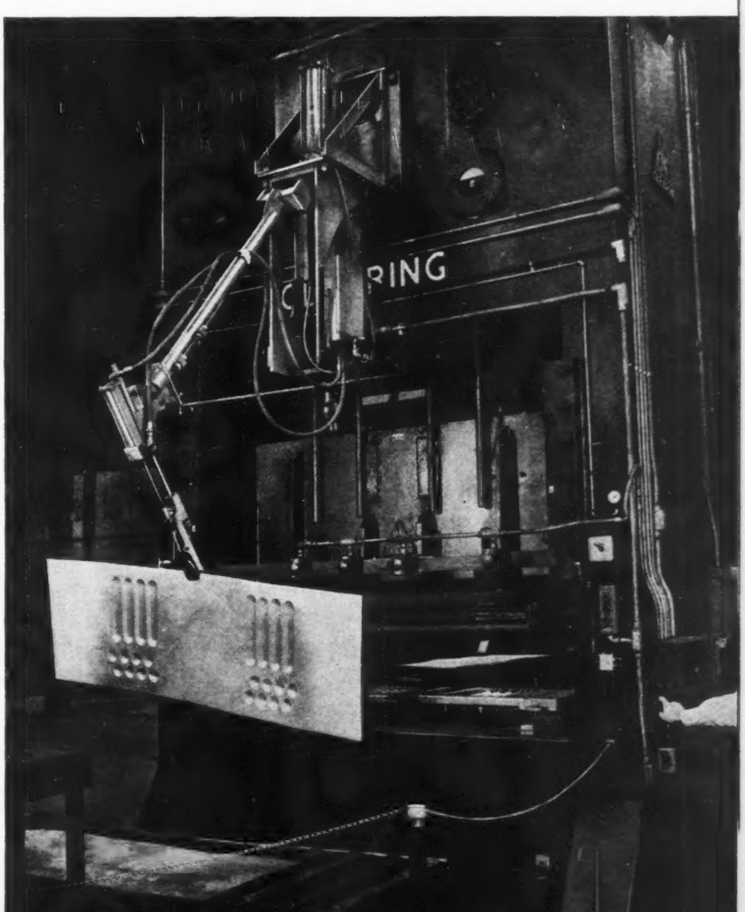


Fig. 1. An "Iron Hand" automatically unloads the drawn sheet from the die, turns it over, and drops it on a gravity roll conveyor leading to the next press



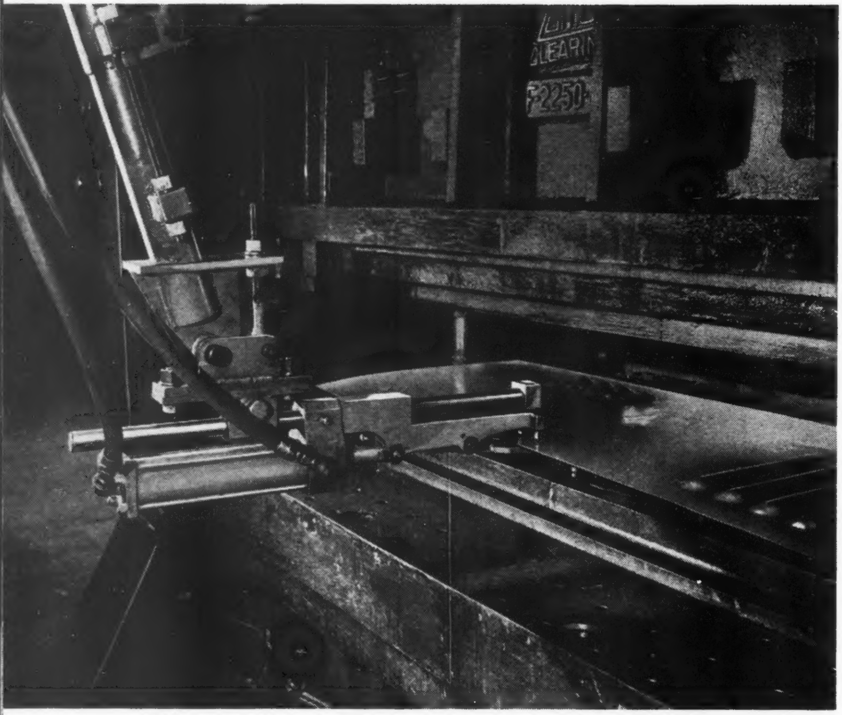


Fig. 2. The automatic press unloader can be provided with different types of jaws to suit various conditions. The jaw shown here is of the chisel type, which digs under the stamping and lifts it from the die

which carries it to the next press. Prior to the installation of this mechanical unloader, the operator of the second press had to remove the stamping, turn it over, carry it about 15 feet, and load it into the second drawing die. Now that these operations are performed mechanically, his job is simplified considerably, resulting in less fatigue and decreasing the chance of accident.

In the second operation, performed on the Clearing 250-ton press seen at the right in the heading illustration, wrinkles are ironed out and the contours of the shelf-supporting embossments are sharpened. The "Iron Hand," a close-up view of which is seen in Fig. 2, unloads the drawn oven liner and lays it on another gravity roll conveyor leading to the third press. In this instance, the unloading mechanism is set so that the sheet is not turned over.

On the third press in the production line, the drawn oven liner is notched, trimmed, and perforated. An "Iron Hand" is also provided on this press to unload the stamping, turn it over, and place it on a conveyor leading to the bending and welding machines.

Different jaws can be applied to the "Iron Hand" to suit various types of dies or workpieces, and lifting conditions. Those shown in Fig. 2 are of the so-called "chisel" type—the lower jaw member being a chisel-edged blade which digs under and scrapes the part off the die. Safety bolts projecting upward from the front edge of the bed prevent the stamping from being pushed out at the front of the press. The upper jaw member is provided with two cone-pointed grippers.

Manual methods of unloading previously employed were slow, dangerous, and costly. The increased speed with which the work is now unloaded permits utilizing the full productive possibilities of the presses. Also, since it is unnecessary for the worker to place his hands or arms within the die area during unloading, there is no danger of accidents.

* * *

Increased Shipments of Milling and Drilling Machines in 1950

The total value of milling machines shipped during 1950 amounted to $35,800,000, a gain of 14 per cent over 1949. As in 1949, the principal milling machines shipped were of the bed and knee types. These machines accounted for 64 per cent of the total value shipped. Shipments of drilling machines during 1950 increased 30 per cent in value over those of 1949, amounting to $32,800,000. Almost half of this amount was accounted for by multiple-spindle drilling machines (way and special types), which were valued at $16,000,000.

* * *

The development of laminating resin that will withstand temperatures up to 500 degrees F. has been announced by U. S. Rubber Co. The new resin is said to have physical and handling properties similar to other polyesters, but greater heat resistance. It is now being tested for use in high-speed aircraft and guided missiles.

Hard-Facing—A Means of Maintaining Machines and Equipment

By GILBERT C. CLOSE

CONTINUAL improvement in hard-facing alloys has made the hard-facing process highly important in the maintenance of many types of heavy industrial equipment. With replacement parts growing scarce and more costly, it is logical to assume that this application of the process will become even more important in the near future.

Specifically, hard-facing is a welding process wherein an overlay of metal is added to a part to restore its original dimensions or to increase its hardness. Some of the alloys are applied manually by arc or gas welding. When available in wire form, the most efficient method of application is with an automatic welder.

Hard-facing alloys are available in a wide range of physical and chemical properties. Some are quite soft, and others range up to 60 Rockwell C in hardness. Extreme abrasion resistance is characteristic of some of these alloys, while in other cases, high impact resistance is provided. There are special corrosion-resistant alloys, along with alloys that maintain high strength and hardness at elevated temperatures. Some can be machined; others cannot. Again, some are work-hardenable, and can be forged after application. With this wide selection, it is possible to select an alloy or a combination of alloys with characteristics to meet the requirements of the operating conditions that are most commonly encountered.

Maintenance work being accomplished at the plant of the Shepherd Tractor & Equipment Co., Los Angeles, Calif., is a good example of how hard-facing alloys can be used to cut costs and speed repair work on heavy-duty earth moving equipment. The principal uses of the alloys at this plant are to hard-face crawler tractor track rails, track rollers, and idler rollers. These parts are subject to rapid wear as a result of extremely abrasive conditions and heavy loading, since they operate without lubrication.

Two hard-facing alloys are used to provide the required combination of wear and abrasion resistance. Stoody Alloy No. 105, available from the Stoody Co., Whittier, Calif., is employed for hard-facing the track and idler rollers, and Mir-O-Col Alloy No. 4, available from the Mir-O-Col Alloy Co., Los Angeles, is used for hard-facing the track rails. The Stoody alloy comes in wire form, suitable for use on an automatic welding machine. The wire is hollow, and contains the alloying constituents in core form. As a result, alloying is actually accomplished while the metal is in a molten state during welding.

Prior to welding, the rollers are wire-brushed to obtain clean contact surfaces for the welding machine. They are then placed on the machine and rebuilt to the required diameter, as seen in Fig. 1. The hard-facing material may be applied to a depth of up to 1/4 inch in four passes. The rebuilt part is used in the "as welded" condition

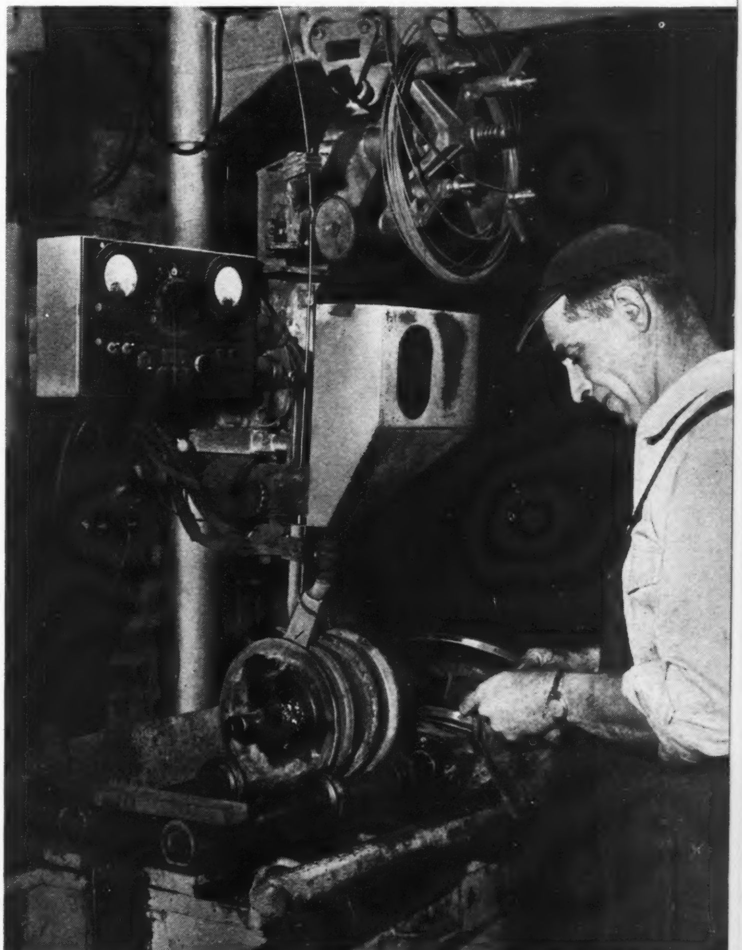


Fig. 1. Hard-facing track rollers in an automatic welding machine. A flux-submerged arc is used. The alloying constituents are contained in the hollow wire

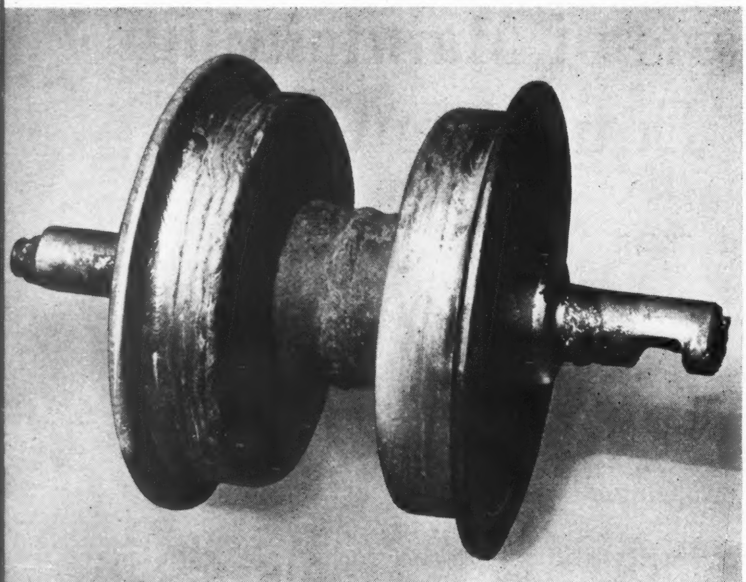


Fig. 2. The rebuilt roller has equal or greater resistance to wear than a new part. No finishing is required after hard-facing

without grinding or finishing of the welded surface, as shown in Fig. 2. Stoody Alloy No. 105 attains an immediate hardness of from 46 to 48 Rockwell C, and is not work-hardenable.

The Mir-O-Col alloy is applied to the track rails by hand arc-welding. The alloy comes in the usual arc-welding rod form, with flux. After the tracks have been disassembled from the tractor, they are laid on the ground with the rail up. A motor-driven wire brush is used to remove any rust and dirt from the surface. While such cleaning is not imperative, an excess of rust or dirt might result in a somewhat porous coating.

After being brushed, the rails are preheated to approximately 350 degrees F., using a gas torch (see Fig. 3). Preheating reduces the expansion of the base metal during welding, and partially eliminates cooling strains in the hard-facing material. Only a small portion of the rail is preheated at one time to prevent cooling before welding can be accomplished.

The thickness of the hard-facing material applied to the rails averages about 1/8 inch. This is accomplished in two passes with the rod, as illustrated in Fig. 4. With a bit of experience, the operator can apply the metal in uniform layers and obtain a relatively smooth finish. No machining or grinding is required after the metal is applied. The appearance of the track rail after hard-facing may be seen in Fig. 5.

Mir-O-Col Alloy No. 4 is a work-hardenable composition. When first applied, it attains a hardness of from 25 to 30 Rockwell C. Later, under the cold-working action resulting from operation, it attains a hardness of from 45 to 50 Rockwell C. It should be pointed out that while harder alloys are available, this hardness range is the best for obtaining the greatest wear from both track rails and pulleys, which operate together under conditions of non-lubricated metal-to-metal friction.

The use of these two alloys on the track rails and rollers offers the ultimate in wear resistance for the peculiar requirements involved. Under other conditions of use, different alloys or combinations might give better results.

Neither of these hard-facing jobs requires a great deal of time nor special equipment. The hollow wire can be used on any automatic welder by adjusting the feed pressure to prevent crushing. No special experience is required. The result of the hard-facing operations is a track rail and roller combination rebuilt to size, with wearing properties equal to or better than that of new replacement parts.

Fig. 3. Preheating a crawler tractor track rail prior to application of the hard-facing material. Preheating reduces expansion and cooling stresses during the welding

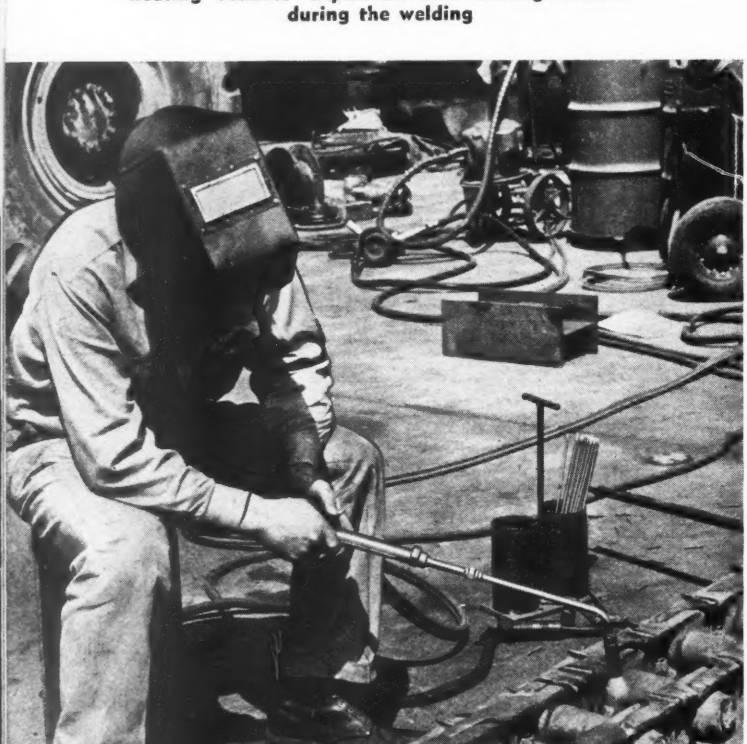


Fig. 4. Following preheating, as shown in Fig. 3, a 1/8-inch hard-facing overlay is built up by hand welding in two passes on a tractor track rail

The applications of hard-facing are far too numerous to cover in a single article. Those described here are merely typical, but they indicate how hard-facing alloys can be incorporated into a maintenance program to give maximum results at lowest costs.

By all indications, replacement parts will become much more difficult to obtain as the defense program swings into full gear. Greater attention will have to be paid to the rebuilding and salvaging of machine units to save both material and time. Hard-facing can solve a lot of these problems.

* * *

One of World's Smallest Gas Turbines

A new gas turbine, one of the smallest in the world, is rapidly becoming one of the most important accessory units in jet and turbine propeller-driven airplanes. It is used to give jet and turbo-prop airplane pilots dependable self-starting. This unit is completely enclosed in a chromium-nickel stainless steel envelope and, including automatic controls and integral cooling, it weighs approximately 150 pounds.

The turbine rotor assembly, known as the "hot wheel," operates at speeds of 40,000 R.P.M. and at temperatures of 1600 degrees F. Inconel "X," a high nickel-chromium-iron alloy which is used in this assembly, is the only material tested by Airesearch Mfg. Co., which did not expand and cause seizure at these speeds and temperatures.

* * *

New York City Evening Courses in Mechanical Technology

The Institute of Applied Arts and Sciences, the New York City unit of the State University of New York, is planning a wide variety of evening courses in mechanical technology, with classes starting February 8. Included in this program are courses in technical drawing principles, engineering drawing, technical mathematics, physics, strength of materials, machines and tools for production, production planning and control, machine design, industrial management, tool design, metallurgy, and industrial heat and power. Further information can be obtained by writing to the Extension Division of the Institute of Applied Arts and Sciences, 300 Pearl St., Brooklyn, N. Y.

Fig. 5. Appearance of track rails after hard-facing. The black substance is the welding flux, which is coated on the welding rod. No machining or finish-grinding is required

Materials OF INDUSTRY

The Properties and New Applications of Materials Used in the Mechanical Industries

Air-Hardening Type of Flat Ground Die Steel

An air-hardening type of steel for use in making punches and dies has been announced by the Simonds Saw & Steel Co., Fitchburg, Mass. This steel has the following chemical analysis: Carbon, 0.95 to 1.05 per cent; manganese, 0.50 to 0.70 per cent; silicon, 0.30 to 0.50 per cent; chromium, 5 to 5.50 per cent; molybdenum, 0.90 to 1.10 per cent; and vanadium, 0.20 to 0.30 per cent.

The 5 per cent chromium content imparts the wear resistance required of punches and dies that are to be used on silicon or stainless steel, Monel metal, or other types of abrasive metal. The wide hardening range (1700 to 1800 degrees F.) of this steel simplifies heat-treatment, and its spheroidized microstructure provides good machinability.

The new steel is available in forty-three standard stock sizes ranging from 1/2 inch by 2 inches to 2 inches by 10 inches in 36-inch lengths. All sizes are accurately ground to a thickness limit of plus or minus 0.001 inch and a surface finish of 25 to 35 micro-inches.

New Lubricating Coolant for Use in Metal-Cutting Operations

Increased effectiveness of lubrication and heat dissipation in metal-cutting operations are said to be obtained by the use of "Cool-O-Lube," a lubricating coolant developed by the Air Conversion Research Corporation, 4107 N. Damen Ave., Chicago 18, Ill. When used with the "Pur-o-luber," which is the equipment recommended for handling this coolant, its effectiveness is increased, since it is carried by a compressed air stream. However, good results are also obtained when it is applied by conventional methods.

The solution is supplied as a concentrate, and is diluted by the user in the proportion of one part of solution to nine parts of water. It is a non-injurious, smokeless, odorless, non-rancid, non-rusting coolant with high film strength, super-oiliness, and low viscosity. The manufacturer claims that it will absorb 2 1/2 times more heat than oil, and states that it can be removed with water.

Medium High-Strength Plastic Sheet Designed to Resist Stress

A medium high-strength glass-fiber reinforced plastic sheet has been placed on the market by the Dynakon Corporation, 5509 Hough Ave., Cleveland 3, Ohio. This plastic sheet, known as Dynakon G1A, is designed for applications in the electrical and chemical fields where stress is encountered. It has a tensile strength of 19,000 pounds per square inch, a compressive strength of 24,000 pounds per square inch, a dielectric strength of 325 volts per mil, an arc resistance of 120 seconds, a power factor of 4.7, a dielectric constant of 4.40, and a specific gravity of 1.49.

This plastic resists the action of acids, salts, and mild alkalies, as well as organic solvents. It is available in sheets 18 by 28 inches in size, with thicknesses of 1/16, 1/8, 3/16, 1/4, 3/8, and 1/2 inch.

Anti-Rust Paints Applicable to Rusted Surfaces

Two penetrating and sealing anti-rust paints that can be applied directly over rusted surfaces are recent products of the Paint Corporation of America, Fidelity Bldg., Cleveland 14, Ohio. These paints, known as PCA-100 and PCA-101, are said to prevent rust from forming on new metal and also to stop further corrosive action in cases where rust has already started.

Application to rusted surfaces can be made without extensive surface preparation, such as wire brushing, scraping, or sand-blasting. These paints are said to penetrate through the rust layer into the base metal and seal the surface against further rusting. They are suitable for

either brush or spray application, and for either interior or exterior use.

PCA-100 is furnished only in black, and is recommended solely for a finish coat. PCA-101 is a clear paint that can be painted over with any color standard paint.

All-Purpose Cleaner for Metal Parts

An effective cleaner for all kinds of metal parts has been announced by the Magnus Chemical Co., Garwood, N. J. This cleaner, known as "Magnus 751," is safe for all metals. It is non-inflammable, cleans at high speed, and penetrates, loosens, and removes all foreign deposits, including paints and other coatings.

This cleaner exhibits long life in either a hot or cold solution and is followed by a simple cold-water rinse after the cleaning period. Uses include the removal of carbonized oil and gums from aircraft-engine parts, Diesel-engine parts, and other units, and the cleaning of carburetors, fuel pumps, pistons, rocker-arm assemblies, and rear-end transmission and brake parts.

Tumbling Compound for Metals and Plastics

"Tumb-L-Magic" is the name given to a new wet-process tumbling compound for metal and plastics finishing brought out by Tumb-L-Matic, Inc., 4510 Bullard Ave., New York 70, N. Y. This compound is said to suspend grease and cuttings in the tumbling solution, thus keeping the work surfaces and abrasive media free from action-retarding accumulations. The use of the new compound in conventional tumbling equipment is said to enable a high finish to be produced rapidly.

Finishing Compound for Brass, Bronze, Copper, Gold, and Silver

Blue Magic Compound No. 1 (Double Strength) is a special-purpose chemical developed for barrel finishing of brass, bronze, copper, gold, and silver stampings, castings, and machined and drawn parts. It is a product of the Blue Magic Chemical Specialties Co., 2135 Margaret St., Philadelphia 24, Pa. The new compound is a highly concentrated paste designed to be used in small quantities. It is said to yield uniform metallic colors and finish in short time cycles. In combination with certain non-ferrous tumbling materials, it can be used for roughing, deburring, cleaning, and finishing in one operation.

Cutting Compound for Use in Machining Stainless Metals

Solution of some of the problems encountered in machining stainless and other alloy metals has been found in the use of C-5 cutting compound, a product of the Felt Products Mfg. Co., 1504 Carroll Ave., Chicago 7, Ill. This compound is said to prevent galling and pitting of metal surfaces, permit higher cutting speeds, and assure greater accuracy of the work through the maintenance of uniform cutting temperatures. High temperature and pressure resisting qualities are said to be advantages of this cutting compound. It is recommended for boring, turning, tapping, threading, broaching, grooving, sawing, and other metal-cutting operations.

Flux-Containing Pre-Forms for Brazing or Silver Soldering

The development of pre-forms for brazing or silver soldering has been announced by PresSint Products, Lyndhurst, Ohio. These pre-forms are made from powdered alloys containing flux. The metal parts to be joined, together with the pre-form, are heated by flame, atmosphere furnace, or induction heating furnace in the brazing or silver-soldering operations. Pre-forms are made up especially to suit the applications for which they are required. Use of these pre-forms is claimed to result in uniform and efficient brazing or soldering.

Coating that Protects Metals, Concrete Structures, and Wood

The Flash-Stone Co., Inc., 30 E. Rittenhouse St., Philadelphia 44, Pa., has developed a fast drying protective coating made from coal-tar pitch. The pitch is broken down into minute molecules and then combined with water and a stabilizing emulsification agent to form a permanent suspension that can be brushed or sprayed on the part to be protected.

"Tarlac," as the coating is called, is said to retain all the protective and adhesive qualities of coal-tar pitch and to be impervious to oils, greases, other petroleum derivatives, alkalies, acids, etc. It will not crack or run within a temperature range of —56 degrees to 200 degrees F.

This coating dries and forms a tough, enduring, flat black film that is completely insoluble in water, oil, or gasoline. It can be thinned when necessary with water. Uses include protective coatings for concrete structures, floors, masonry, and metals exposed to corrosive elements.

Angular Facing on Bench Lathe Facilitated by Swiveling Cross-Slide

By FRITZ L. KELLER

TOOLMAKER'S bench lathes that are not equipped with a lead-screw or taper turning attachment are sometimes difficult to set up for machining tapers or angular faces. On some bench lathes, the graduations provided for swiveling the compound rest have a range of only 60 degrees. If extra care is taken to set the compound rest at an angle beyond the range of graduations, the ball-crank handles on the compound rest and cross-slide may interfere with each other. This can be avoided on certain lathes by swiveling the cross-slide.

A schematic drawing of the method employed to hold the cross-slide to the bed on one such lathe is seen in Fig. 1. By simply loosening the lock-nut beneath the bed and retracting the adjustable stop mounted below the cross-slide, the cross-slide can be swiveled through the desired angle.

With this method, the compound rest is used for angular facing or taper turning when the range of graduations is sufficiently large. However, when the angular face is beyond the range of graduations, the compound rest is set parallel with the lathe bed and used for cylindrical turning, while the cross-slide is set at the required angle and used for facing. In this way, both cylindrical and angular faces of the work-piece can be machined in one continuous operation without resetting the rest or slide.

The cross-slide can be set to the required angle in several ways. With one method, a protractor is held against a parallel placed in the slot of the lathe bed, as seen in Fig. 2, while the cross-slide is swung into parallel alignment with the pre-set protractor.

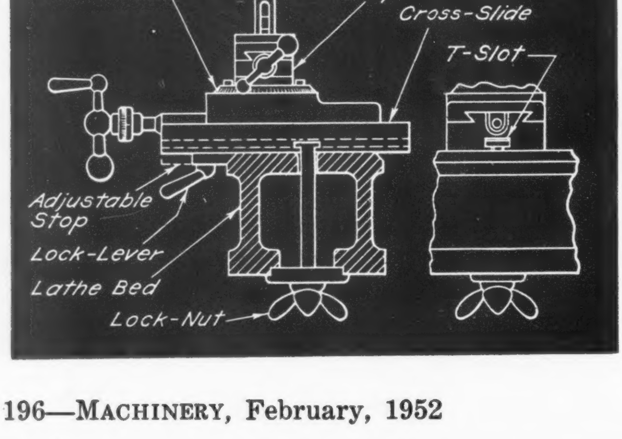
In aligning the compound rest with the lathe bed, a micrometer, feeler gage, or test indicator, (Fig. 3), can be used to check the parallelism of the compound-rest movement with the longitudinal axis of the lathe. After turning an oversize cylindrical work-piece, the diameter at both ends of the part can be measured to insure that the compound rest moves parallel with the lathe axis. Or a finished work-piece can be chucked in the lathe and a test indicator or feeler gage, held between the tool and work, can be used to check the parallelism.

With the work-piece shown in Fig. 2, which has an end face forming an angle of 10 degrees, the angle between the compound rest and the cross-slide is 80 degrees. Thus a simple trigonometric calculation can be made to determine the amount that the cross-slide must be fed in to remove a certain amount of stock from the periphery of the work. The triangle used in this calculation is shown in Fig. 4, where:

a = forward movement of tool;
b = desired depth of cut = one-half the difference between the diameters before and after turning;
c = cross-slide movement; and
A = angle of end = face on work-piece = angle at which cross-slide is set.

For example, with a depth of cut of 0.050 inch (to remove 0.100 inch from the diameter of the

Fig. 1. (Below) Schematic drawing of method employed to hold cross-slide to lathe bed. By loosening lock-nut and retracting stop, cross-slide can be swiveled



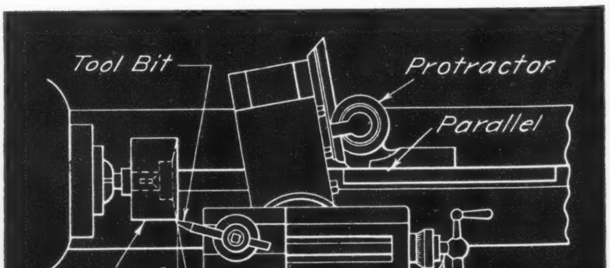


Fig. 2. (Above) Cross-slide is aligned with pre-set protractor that is held against a parallel placed in slot of lathe bed to obtain desired angular setting

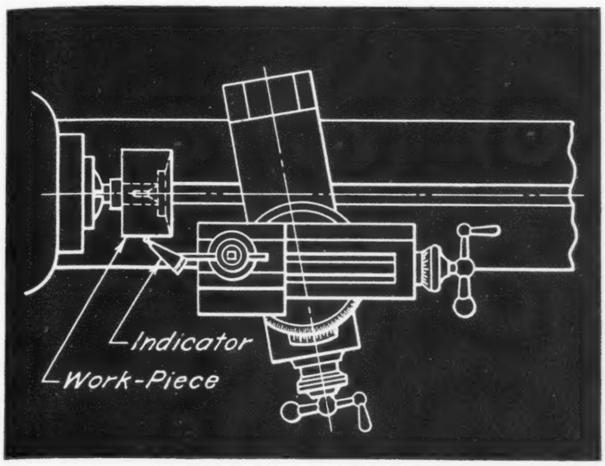
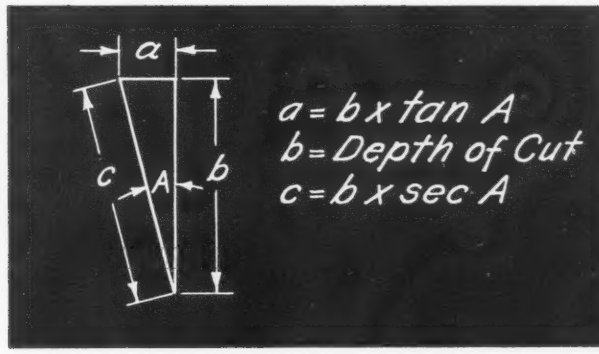


Fig. 3. (Above) With a finished work-piece in the lathe chuck, and a test indicator in the toolpost, parallelism of compound-rest movement can be checked

Fig. 4. (Below) Triangle in which (c) represents the distance through which the cross-slide must be moved to obtain a depth of cut equal to (b); (a) equals forward movement of tool; and (A) equals angle at which cross-slide is set



work), the solution of the triangle would be as follows:

$$a = b \times \tan A = 0.050 \times \tan 10 \text{ degrees}$$
$$= 0.050 \times 0.17633 = 0.0088 \text{ inch}$$
$$c = b \times \sec A = 0.050 \times \sec 10 \text{ degrees}$$
$$= 0.050 \times 1.0154 = 0.05077 \text{ inch}$$

While there is little difference between b and c with a depth of cut of only 0.050 inch, this difference will increase with heavier cuts or greater angular settings.

* * *

Increased Output of Steel

Steel mills have increased their output by some 20 per cent in two years. This expansion includes the output from blast furnaces, steel melting furnaces, rolling mills, and steel processing equipment. Electric arc furnace tonnage increased more than fourfold in the last ten years, and now accounts for about 8 per cent of the total steel production. This figure is fast growing because of improved electric furnaces, low power rates, and increased fuel costs—factors that make electric steel cost competitive with open-hearth steel.

* * *

The first large-scale, self-contained plant for the production of titanium metal will be constructed at Henderson, Nevada, by the Titanium Metals Corporation of America, a company owned jointly by the National Lead Co. and the Allegheny-Ludlum Steel Corporation. The new plant is expected to multiply the present production of titanium metal eightfold.

Clearing House for Suggestions to Improve Productivity

Secretary of Commerce Charles Sawyer has announced plans for the creation in the Department of Commerce of a national clearing house for suggestions to improve industrial productivity. This clearing house will be organized to create a central location for the pooling and interchange of ideas to benefit the nation's current defense production efforts.

The Secretary said that the new activity would be undertaken in a modest way, on as nearly a self-supporting basis as possible. It is to be a voluntary effort by the nation's manufacturers, in which they will cooperate for the benefit of one another, with the Department acting as the means for collecting, pooling, and redistributing ideas so that they will reach all industry.

The following measures will be taken to get the clearing house under way:

1. Letters will be sent to industrial leaders asking their cooperation and requesting them to designate officials in charge of forwarding beneficial suggestions. These officials will be expected to send their ideas, suitably explained and illustrated, to Suggestions, U. S. Department of Commerce, Washington 25, D. C.

2. The material will be handled by the Department's Office of Technical Services, which will digest the suggestions and incorporate them into a news letter to be circulated among interested industries.

3. For manufacturers who desire full data on suggestions listed in the news letter, the Department will furnish photocopies at charges approximating cost of reproduction and distribution. Firms contributing the suggestions will be properly credited.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Liability for Equipment after Cancellation of Lease

A. C. K.—Our lease on a building expired, and before we could remove our equipment, a fire destroyed the building. Can we sue and recover the loss we sustained as a result of the fire from the landlord of the building?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

According to a recent higher court, tenants who leave or vacate leased premises should be certain to take away all equipment, merchandise, machinery, and other articles of value. If this is not done, the landlord will not be liable in case of loss by theft or fire.

In Serrano vs. Peter Paul, Inc. [152 Fed. (2d) 863], it was shown that the owner of a certain property cancelled a lease. At the time the lease was cancelled, there was a large amount of machinery, supplies, materials, and equipment that had been used by the tenant, remaining in the plant. This equipment was completely destroyed by fire. The tenant sued the property owner for the value of the destroyed equipment.

In holding the property owner not liable, the higher court held: "There was no evidence of an agreement by the property owner to hold the equipment for safekeeping or to become responsible for it." Therefore, unless you prove that the fire was due to gross negligence or intent of the landlord you cannot recover from him.

Scaling in Cast Iron

G. K.—What alloy cast iron composition is suitable for applications in which ordinary gray iron is subject to severe scaling at high temperatures? The service does not warrant the use of one of the high-alloy materials.

Answered by Editor, "Nickel Topics," Published by International Nickel Co., Inc., New York City

Most of the work related to the scaling of cast iron is associated with tests for "growth," which is, in general, a manifestation of the rate of oxidation. Some of the oxidation is internal and some is in the form of surface scale.

It is possible to add nickel to a cast iron up to 4 or 5 per cent and reduce its susceptibility to growth, provided the composition is adjusted to contain less than the normal amount of silicon. Apparently silicon is more readily oxidized than nickel. It is far more practical and simple to accept the grade of cast iron already in production at your foundry and add chromium, which possesses a high resistance to oxidation, to the regular mixture, with as much nickel as is necessary to maintain machinability and also avoid entering into the martensitic or hard machining compositions. This procedure involves using 1 to 2 per cent nickel plus 1/2 to 1 per cent chromium. Such irons possess good machinability, in addition to improved resistance to growth and scaling.

A typical chemical specification for a scale-resisting iron is as follows: Total carbon, 3.10 to 3.25 per cent; silicon, 1.25 to 1.50 per cent; manganese, 0.60 to 0.80 per cent; nickel, 1.25 to 1.75 per cent, and chromium, 0.50 to 0.90 per cent. Castings of this composition should possess a resistance to scaling 25 to 50 per cent better than unalloyed products. The degree of variation depends on the severity of the operating conditions.

* * *

High-Speed Automatic X-Ray Inspection

A tiny cadmium sulphide crystal that apparently amplifies one million times will be the heart of a new system for high-speed automatic X-ray inspection of industrial products, according to an announcement by the General Electric Co. These crystals, which can be "grown" in sizes from a fraction of a millimeter to several millimeters, act as amplifiers when excited by X-radiation. On an area for area basis, they are up to a million times more sensitive than conventional ionization chambers and a thousand times more sensitive than photo-electric cells. Sensitive, stable, and responsive, the crystals do the work formerly handled by a complex system of electron tubes and amplifiers, while at the same time allowing the use of comparatively low-intensity X-rays.

INGENIOUS *Mechanisms*

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Intermittent Worm-Gear Train

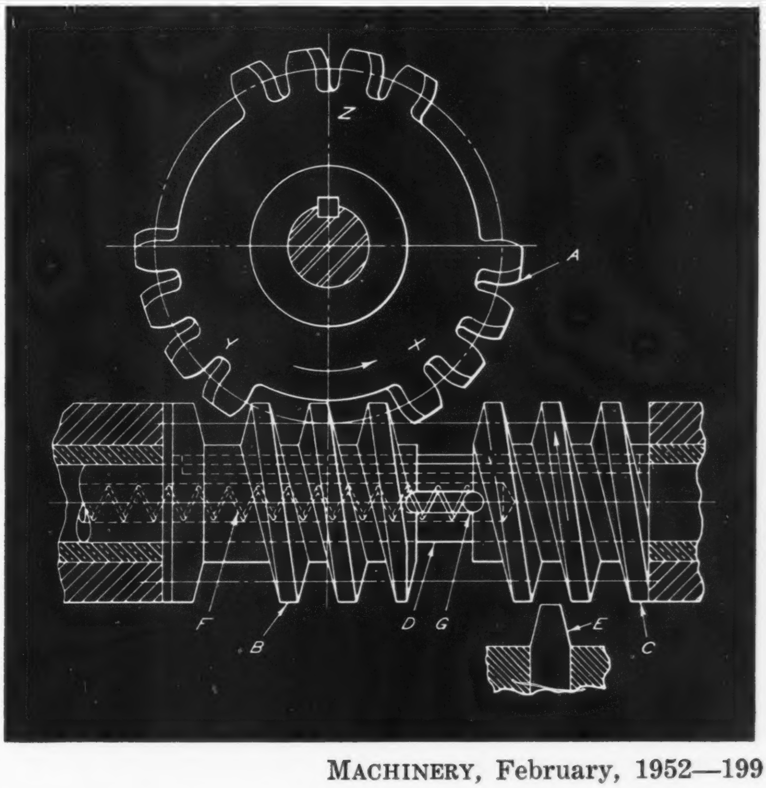
By H. B. SCHELL

The worm-gear drive shown in the accompanying illustration was designed to provide intermittent motion. It consists of a worm-wheel *A* having teeth at the sectors marked *X*, *Y*, and *Z;* worms *B* and *C*, mounted on and keyed to shaft *D;* and a plunger *E*. Worm *B* is fixed in position on the shaft, while worm *C* is so mounted that it is free to slide. The helices of these worms should be continuous.

In order to hold worm *C* to the right, out of engagement with the worm-wheel, a spring *F* is provided, located in a longitudinal hole in shaft *D*. A cross-pin *G*, extending through a slot in the shaft and engaging a seat in worm *C*, transmits the spring pressure to this worm. A similar seat is provided in worm *B* for this pin. The spring is suitably secured at its left end.

The operation of the device is as follows: With shaft *D* rotating in the direction shown by the arrow, it will be apparent there will be no rotation of worm-wheel *A* in the position illustrated, since worm *B* is rotating in a plain sector of the worm-wheel. In order to produce rotation of the worm-wheel—in this case one-third a complete revolution—plunger *E* (timed by other parts not shown) rises into engagement with the worm thread. Upon this engagement, the rotating worm *C* moves to the left as its thread feeds along the plunger until the worm engages the last tooth in sector *X* of the worm-wheel. Between this time and the closing of the space between the two worms the plunger must be snapped back out of contact with the worm.

When the end of worm *C* comes in contact with the end of worm *B*, the worm-wheel *A* is rotated in the direction of the arrow, both worms operating as a single unit. After worm-wheel *A* has rotated sufficiently to bring the last tooth of sector *X* out of engagement with worm *C*, spring *F* carries this worm to the extreme right, where it cannot engage the teeth of sector *Y*. When the last tooth in sector *Y* is disengaged from worm *B*, worm-wheel *A* will stop, having made one-third of a revolution about its axis.



Worm-gear train for producing intermittent motion. The worm-wheel (A) is rotated one-third of a revolution, followed by a stationary period, through the action of the two worm-gears (B) and (C)

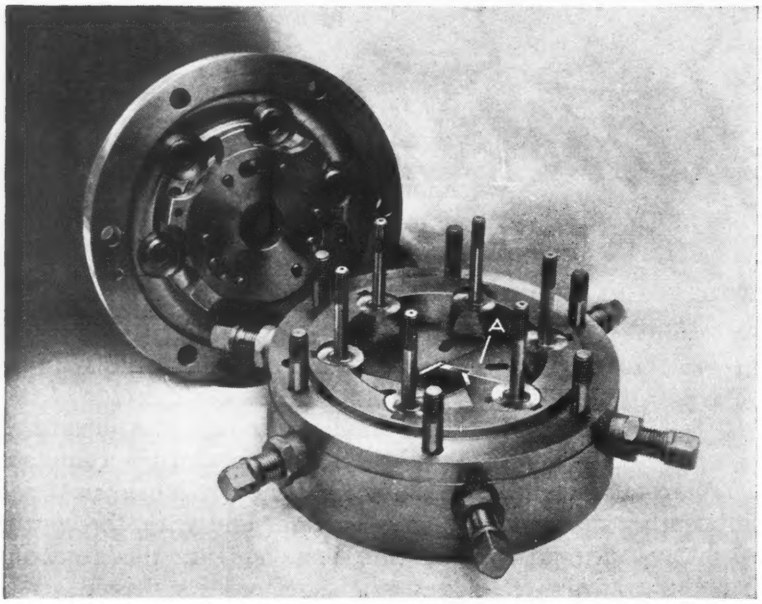


Fig. 1. Several different sizes of hexagonal stock can be cold-drawn in this adjustable carbide-insert die. The view shows the relative positions of the parts, including six carbide-insert pieces (A)

Mechanism for Adjusting Size of "Iris" Drawing Dies

By IVON C. TOBY

A mechanism designed for adjusting the size of hexagonal carbide-insert dies used in cold-drawing hexagonal stock is here illustrated. This mechanism enables one die to be used for drawing a large number of sizes. Three master dies cover the range of all the hexagonal sizes drawn in one cold-drawing mill in Sheffield, England.

The main component of the die is a set of six carbide-insert pieces *A*, Figs. 1 and 2. As the stock is drawn through these insert surfaces it is formed into the shape of a hexagon. The other members of the die act to support, adjust, or lock the carbide-insert pieces.

To understand the principle on which the adjustment of the carbide-insert pieces is based, reference should be made to Fig. 3. Here the relative movement of two of the six pieces is in-

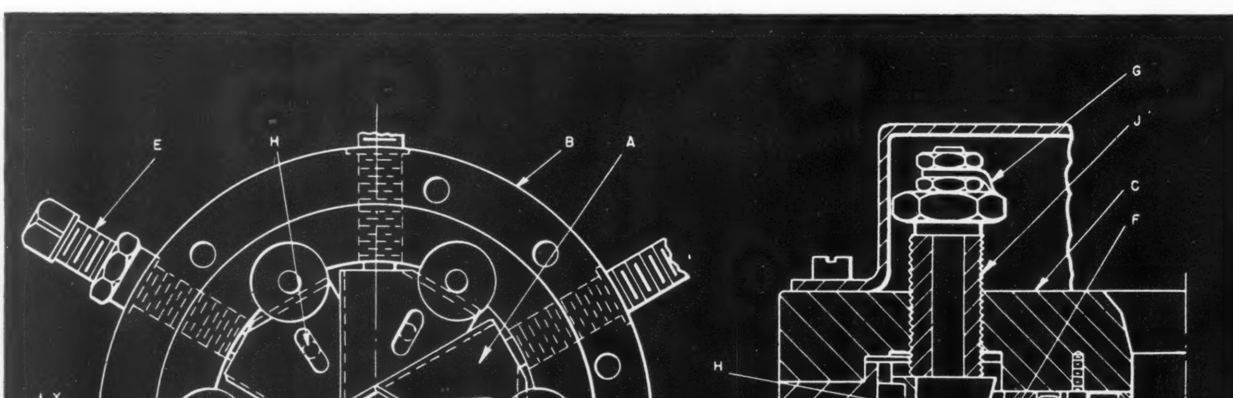
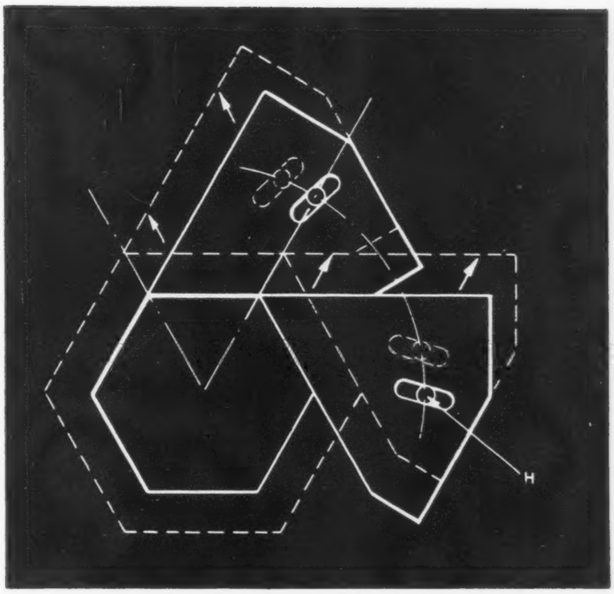


Fig. 2. Plan view and enlarged cross-section of the die illustrated in Fig. 1, showing the arrangement of the various components

Fig. 3. Carbide-insert pieces are moved in a straight line from the solid- to the dotted-line positions as indicated by the small arrows. Pins acting in elongated slots effect this motion



dicated by the arrows. Initially, the pieces are in the position indicated by the solid lines, forming two sides of the solid-line hexagon. If they are moved without rotation into the position shown by the dotted lines, they form two sides of a larger hexagon. The movement of these pieces is effected by the action of a pin *H* inside an elongated slot in each of the pieces. The pins move along the circumference of a circle whose center is the center of the hexagon.

Referring to Figs. 1 and 2, the other members comprising this adjustable die are the body *B*, cover *C*, keyed bar wedges *D*, lock-screws *E*, and a disc *F* that carries pins *H*. Each of these members has a specific function to perform. Die body *B* holds all the component parts, so that the motion of the carbide-insert pieces can be restricted within required limits. Cover *C* supports disc *F*, which is free to rotate a small amount. It also holds the hollow stud and nut arrangement *J*, which positions the wedges *D* vertically.

The purpose of the wedges is to provide a means whereby the carbide-insert pieces can be moved and positioned properly. Adjustment is necessary when the drawing surfaces of the carbide-insert pieces wear. The lock-screws *E*, when in the unlocked position, permit movement of the carbide-insert pieces. In the locked position, they hold the carbide-insert pieces in the correct position for the cold-drawing operation. The pins in disc *F* engage the elongated slots in the carbide-insert pieces. When screws *E* are unlocked, rotation of the disc effects a movement of the carbide-insert pieces to a new position.

Once the die has been set, which is usually done in the maximum open position to minimize any error in shape, it is a rather simple operation to adjust it to the required size. Lock-screws *E*, together with their lock-nuts, are loosened. Three alternate keyed bar wedges *D*, the tops of which have indexing pointers *G*, are next loosened to unlock the six carbide-insert pieces. The purpose of the indexing pointers is to insure the proper locating of these three bar wedges for true hexagonal positioning of the insert pieces in the ensuing locking operation.

The other three alternate wedges are left undisturbed, in order that the true hexagonal shape of the die will be maintained in sliding the insert pieces along the flat surfaces of these wedges from one position to another.

Two knurled pins (not shown) rigidly fastened to disc *F* and extending through elongated slots in cover *C* are used to impart rotation to disc *F*. The pins *H* that are engaged in the slots of the six carbide-insert pieces slide these pieces simultaneously into the new position. When in the required position, the three alternate wedges *D* are properly located by the use of their indexing pointers, and the six lock-screws *E* and their lock-nuts are tightened, thereby locking the die.

* * *

World's Fastest Cold-Strip Mill

Equipment for the world's fastest cold-strip mill was shipped last year to the new Fairless Works of the United States Steel Corporation near Morrisville, Pa., by the General Electric Co. The five-stand mill will roll tinplate 30 inches wide at a record-breaking speed of 7000 feet per minute. Power for the main-drive, direct-current motors is supplied by two separate motor-generator sets, one driven by a 14,000-H.P. motor, and the other by a 10,500-H.P. synchronous motor. A triple-armature twin drive, the first of its type ever built, drives the fifth stand.

In 1951, shipment was also started on the main-drive motors and motor-generator sets for a four-stand cold-strip mill for the same plant. This 80-inch mill will operate at 3120 feet per minute and will be driven by the same total motor horsepower as the five-stand mill.

* * *

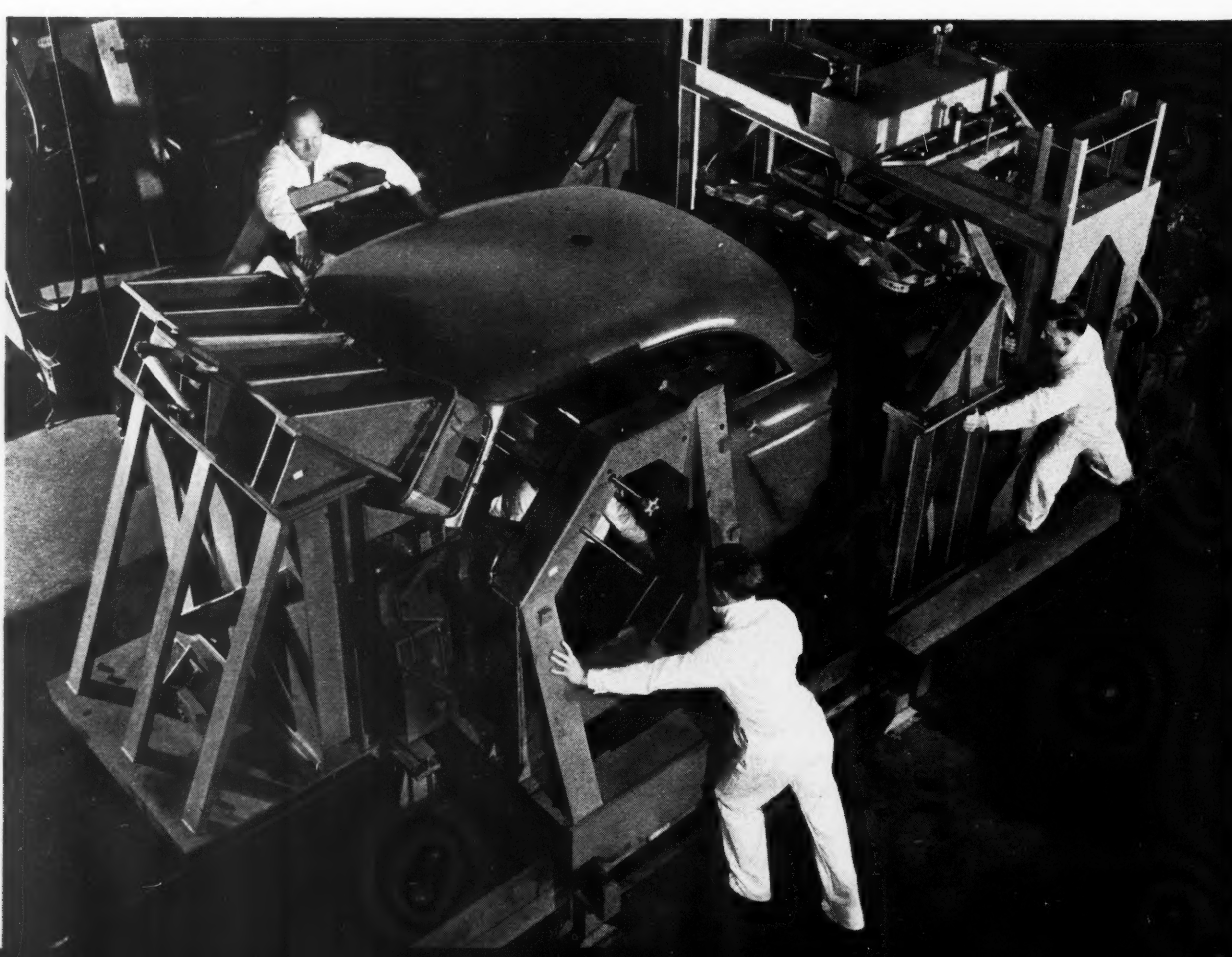
An electrical robot for running machine tools has been developed by the Daco Machine & Tool Co., Brooklyn, N. Y. This comparatively simple device is adaptable to many machines. Perforated paper tape is passed through a sensor, producing varying voltages that control selsyn motors mounted on the tools.

Behind the Scenes Engineering

FOR the first time in the history of the Ford Motor Co., editors of technical magazines and newspaper men were recently taken on a conducted tour through the engineering laboratories at Dearborn, Mich. The visitors followed the many steps involved in the development of automobiles and trucks, from artists' sketches to finished product. They also observed the great number of tests made to insure satisfactory performance of all parts—from spark plugs to springs, including even dampening materials. Typical tests of this kind are illustrated in views at top (right and left).

One of the typical testing machines in the Ford engineering laboratories is used to measure the endurance limits of any metal proposed for use as springs. The specimens being tested are flexed constantly in the machine shown at the left until failure occurs

A new model automobile body begins to take shape in an adjustable heavy-duty welding jig. This jig can be adjusted in all directions so that it can be employed for welding operations on various types and sizes of bodies



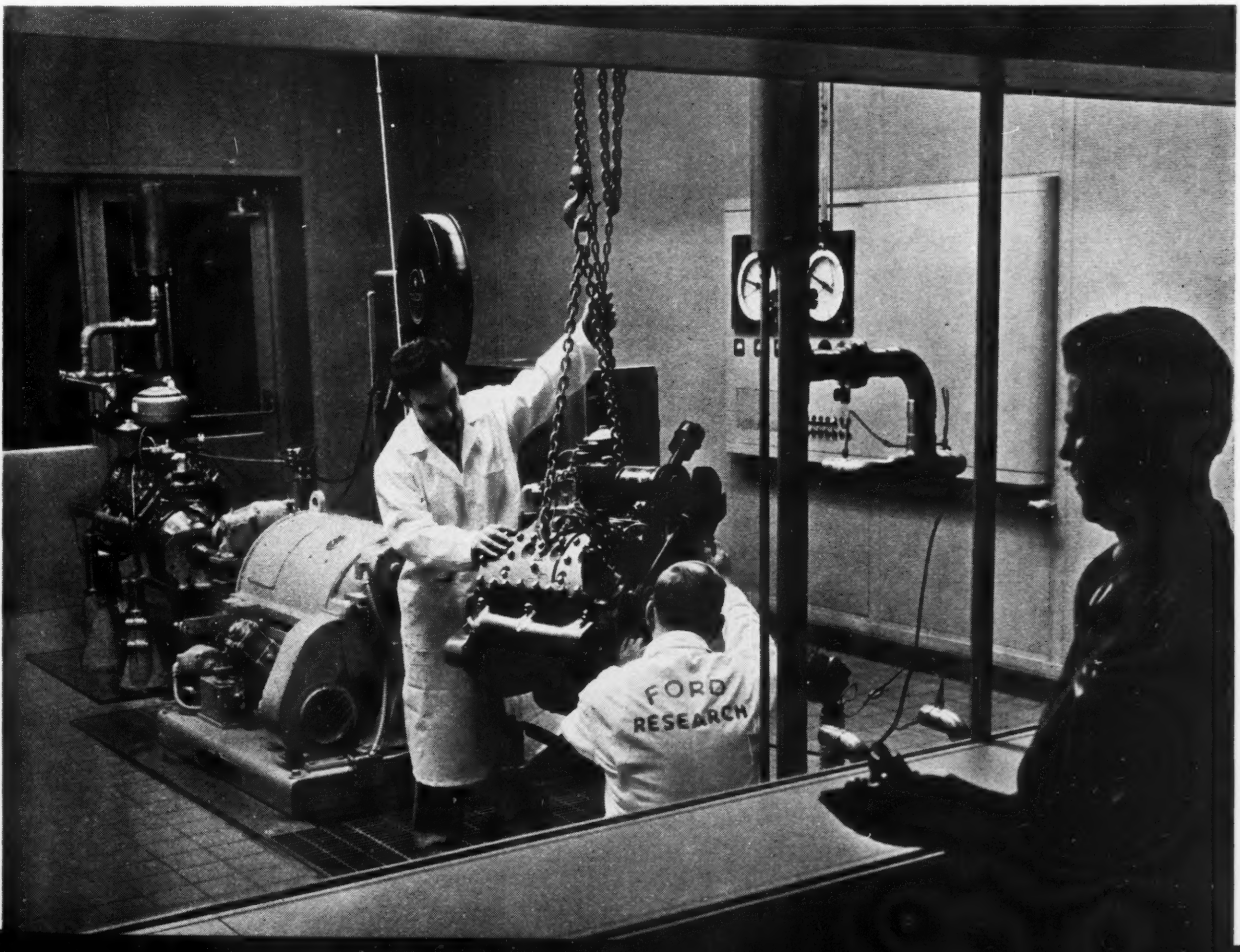
in the Ford Co.'s Laboratories

Mechanisms such as those used for raising and lowering windows or for opening and closing car doors were seen being cam-operated hundreds of thousands of times to insure long wearing qualities. Extensive dynamometer tests were being carried out in a completed wing of the first building in the Ford research and engineering center.

When finished, this center will comprise eleven buildings. All equipment in the dynamometer laboratory is electronically controlled. An impression of the magnitude of the engineering laboratories may be gained from the fact that over 4200 men and women are employed there.

What materials are best for sound deadening in cars and trucks is determined by means of the vibration testing plate here shown. Electronic recording devices of this equipment are so sensitive that they record the dampening effect of a handkerchief

The new dynamometer laboratory has a series of soundproof testing rooms such as the one illustrated. Operations in these rooms may be observed through two-pane glass windows with considerable air space between them



TOOL ENGINEERING *Ideas*

Tools and Fixtures of Unusual Design and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Milling Fixture with a Quick-Release Work-Clamping Device

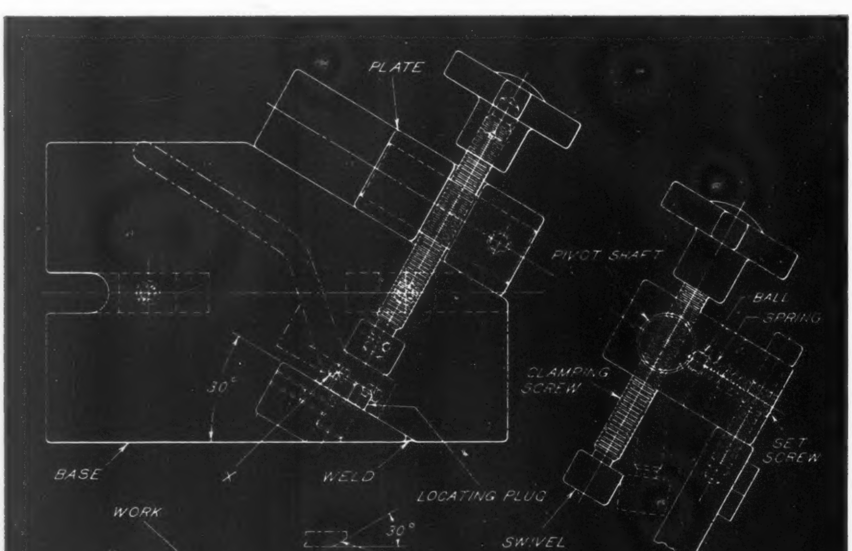
By ROBERT W. NEWTON, Poughkeepsie, N. Y.

The simple, low-cost fixture seen in the accompanying illustration is equipped with a quick-releasing, work-clamping device designed to minimize work-handling time during a minor milling operation. The operation consists of milling a 30-degree chamfer on cast brass handles for railroad engine water valves, one of which is shown by broken lines in the drawing. The chamfered surface, indicated at *X*, has to be milled at an angle of 17 1/2 degrees with the square hole in the handle.

This square hole in the work-piece fits over a hardened locating plug, the shank of which is pressed into a block welded to the base of the fixture. The locating face of the block forms an angle of 30 degrees with the fixture base, and the locating plug is held in position by means of a set-screw, so that the work-piece forms an angle of 17 1/2 degrees with the top of the fixture base. With the work held in this position, the chamfer can be milled to the required angle.

The work is clamped against the locating face of the block by a swivel mounted on the end of a clamping screw. This screw is threaded through a pivot-shaft supported in a plate that is screwed to a 30-degree angular surface on the back of the fixture. A spring-loaded ball, held in this plate, enters one of two seats spot-drilled in the periphery of the pivot-shaft to hold the screw in either the work-clamping or unloading position. In the unloading position, the swivel on the end of the screw is swung away from the work-piece. The tension of the spring acting on the ball can be adjusted by turning the set-screw in the plate below the spring.

In loading work into the fixture, the clamping screw is backed off slightly and swung to the unloading position by lifting the hand-knob pinned to the end of the screw. A casting is then placed on the locating plug, after which the screw is swung upward to the clamping position and rotated until the work-piece is held firmly against the face of the block. After milling, the screw need only be withdrawn slightly and swung downward to unload the part.



Quick-acting, low-cost fixture used in milling a 30-degree chamfer on a cast brass valve handle

Wire Soldering Fixture

By W. M. HALLIDAY, Birkdale, Southport, England

In a certain type of textile machine for spooling a number of yarn threads, provision had to be made for automatically stopping the machine instantaneously upon the breakage of a single thread. This was accomplished by means of a specially shaped "fall wire," one of which was required for every textile thread processed through the machine.

It will be observed from the illustration that the device consists of two bent wires *A* and *B*, made of tempered steel wire approximately 0.025 inch in diameter. Wire *A* is bent to the form of a shepherd's crook, with one end turned over to form the V-notch shown. Wire *B* is roughly U-shaped, its main legs being parallel. A short extension lug is formed at right angles to one side as shown. After forming, these wires were soldered together in the fixture illustrated.

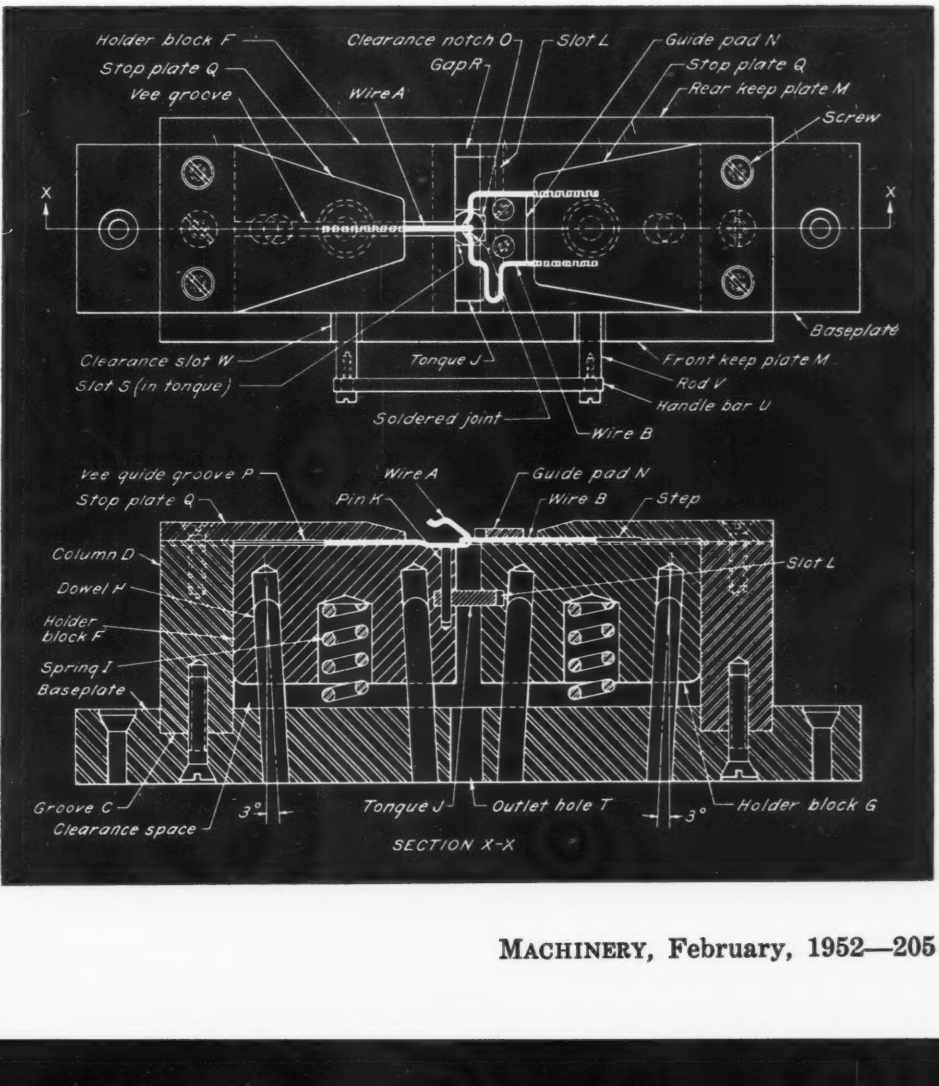
The plan view shows the two wires in the fixture fitted together to form the single unit required in the machine. It will be observed that the V-bend on the end of member *A* is passed over the base of the U-shaped piece *B*, in the center of which is a slight kink for the purpose of correctly locating member *A* in the lateral plane. A clean soldered joint had to be made at this point.

Because of the delicate nature of the duty performed by these wires, and the manner of mounting them in the machine, it was imperative that the two wires *A* and *B* be set and soldered exactly in alignment with each other in both planes. The soldered joint had to be made as strong as possible, but with the smallest amount of excess solder deposited around the joint area.

Referring to the illustration, the steel baseplate of the fixture has holes at each end for screwing the fixture down to the bench. Across the top of the base are two shallow grooves *C*, of exactly the same depth and width. Each groove has its sides perfectly parallel, and they are situated exactly at right angles to the side of the baseplate. Into each groove is tightly pressed a steel column member *D*, made the same width as the baseplate and retained in position by screws. The columns are identical in size and stand perpendicular with the baseplate and parallel with each other.

Situated between these columns is a pair of hardened steel holder blocks *F* and *G*. These blocks are approximately 0.010 to 0.015 inch narrower than baseplate *A*. Blocks *F* and *G* slide vertically on a pair of dowel-pins, which are inclined slightly from the true vertical center line of the fixture to impart a small amount of tension on the two portions of the wire which are to be hooked together prior to soldering. This tension applied to the two wires insures that they will be maintained in close surface contact throughout the critical soldering operation.

The action is as follows: When blocks *F* and *G* are at their highest position, stopped by fixed plates *Q*, the wires will be clamped between the top surfaces of the blocks and the under surfaces of the plates. In this position, the blocks will be



A soldering fixture that rapidly clamps and aligns two bent wires. These wires, which are used in a textile machine, require to be precisely joined

the maximum distance apart, due to the inclination of the dowel-pins on which they slide. When the blocks are depressed they will move inward toward each other, so that the tension on the fall wire components will be released.

Each block is held in the highest position in the fixture by a light compression spring *I*. These two springs not only hold blocks *F* and *G* in the raised position, but also impart the necessary clamping pressure for holding the two wires firmly while soldering. A tongue *J*, located by pin *K*, fits into the right-hand side of the holder block *F* and slides in slot *L* in the left-hand side of block *G*, thus connecting the blocks, so that they act in unison when they are raised or lowered. To enclose the fixture and prevent sidewise movement of blocks *F* and *G*, a pair of plates *M* are employed. These are permanently fixed to the upright columns *D*, one at the front and one at the rear.

In the top of block *G* is a step 0.005 to 0.008 inch in height less than the diameter of the wire components. Fastened centrally on the lowest portion of this step is a guide pad *N* having a thickness equal to twice the diameter of the wires. This pad is a free slip fit between the two parallel legs of the U-shaped wire *B*, and its left-hand side overhangs the end of the block as shown. In this overhanging portion, there is a notch *O*, which is central with the pad and the vertical axis of the fixture, so that it lies immediately underneath the point where the two wire components are connected. The width of this notch is made from five to seven times the diameter of the wire to provide a sufficiently large clearance space for the soldering tool in the working area.

Wire *A* is mounted on block *F* in a shallow V-groove *P*, which is machined centrally across the top of the block, in alignment with wire *B*. This groove must be at the correct height relative to the step on the top of block *G* to allow for the slight "set" formed in the shank of the hooked wire (see plan view). The depth of this groove is also important, and must be carefully determined to allow the wire component to project from 0.005 to 0.008 inch above the top of block *F* for clamping purposes.

Blocks *F* and *G* are approximately 1/4 inch apart in their highest position, thus leaving a gap *R* to allow surplus solder to fall out of the fixture. The tongue *J* has a 1/4-inch wide slot *S* for the same purpose, and the baseplate is drilled immediately underneath this slot to provide outlet hole *T*. To facilitate collection of the surplus solder, the bench may also be drilled underneath hole *T*, and a small detachable receptacle mounted underneath the bench to catch the solder.

To permit the operator quickly to raise and lower blocks *F* and *G* simultaneously, a handle bar *U* connects them loosely. This bar, in which there are small elongated holes, is attached to rods *V* in each of the blocks, at the front side of the fixture. Plate *M* is provided with open-ended elongated slots *W* to give sufficient clearance for the upward and downward movement of the rods. Thus by simply pressing on handle bar *U* at the front of the fixture, both blocks will be forced downward at exactly the same time against the pressure of springs *I*. Immediately upon releasing pressure on the handle *U*, the springs will return the blocks to their highest position to clamp the wires.

To mount a pair of these wires in their respective soldering positions, the first operation is to depress the holder blocks *F* and *G* by pressing on handle bar *U*. The bar is held in the lowest depressed position by means of a small latch which, for the sake of clearness, has been omitted from the illustration.

Wire *A* is mounted first, with its long, straight shank resting in the V-groove *P* underneath stop-plate *Q*. When the blocks occupy the lowest position, a clearance space of approximately 5/16 inch is provided. This distance is, in fact, the maximum amount of vertical movement of the holder blocks. Next the hooked end of wire *A* is set immediately above slot *S* in tongue *J*, approximately central with gap *R*, after which the U-shaped wire *B* is mounted on holder block *G* at the right.

The closed end of wire *B*, containing the slight kink, is first slipped within the hook on the end of wire *A*, and then pulled to the right until both wires are in close contact. The open end of wire *B* is next dropped over the guide pad *N*, thereby aligning it with wire *A*. The ends of the U-shaped wire are placed beneath the right-hand stop-plate *Q*.

It may be necessary to draw each wire slightly apart, so that the kinked portion will be pulled down into the V-bend of the opposite wire. At this stage, the blocks are permitted to rise to their highest position, and in so moving, they pull the wires to make the necessary surface contact at the critical soldering point.

With the wires mounted in this manner, no further setting or manipulation is required of the operator, who is left with both hands free to deal with the soldering tool, application of the flux, etc. Removal of a soldered unit is accomplished merely by depressing the handle bar *U* and lifting the work out of the fixture.

By stop-watch tests, it was found that an operator could mount a pair of wires correctly in position in less than twenty seconds. The actual

soldering operation, using a high-frequency heating device, took twelve seconds, and removal of the finished piece was accomplished in five seconds, thus giving a floor-to-floor production time of thirty-seven seconds per unit.

Adjustable Drill Jig for Unusual Shaped Castings

By ROBERT MAWSON

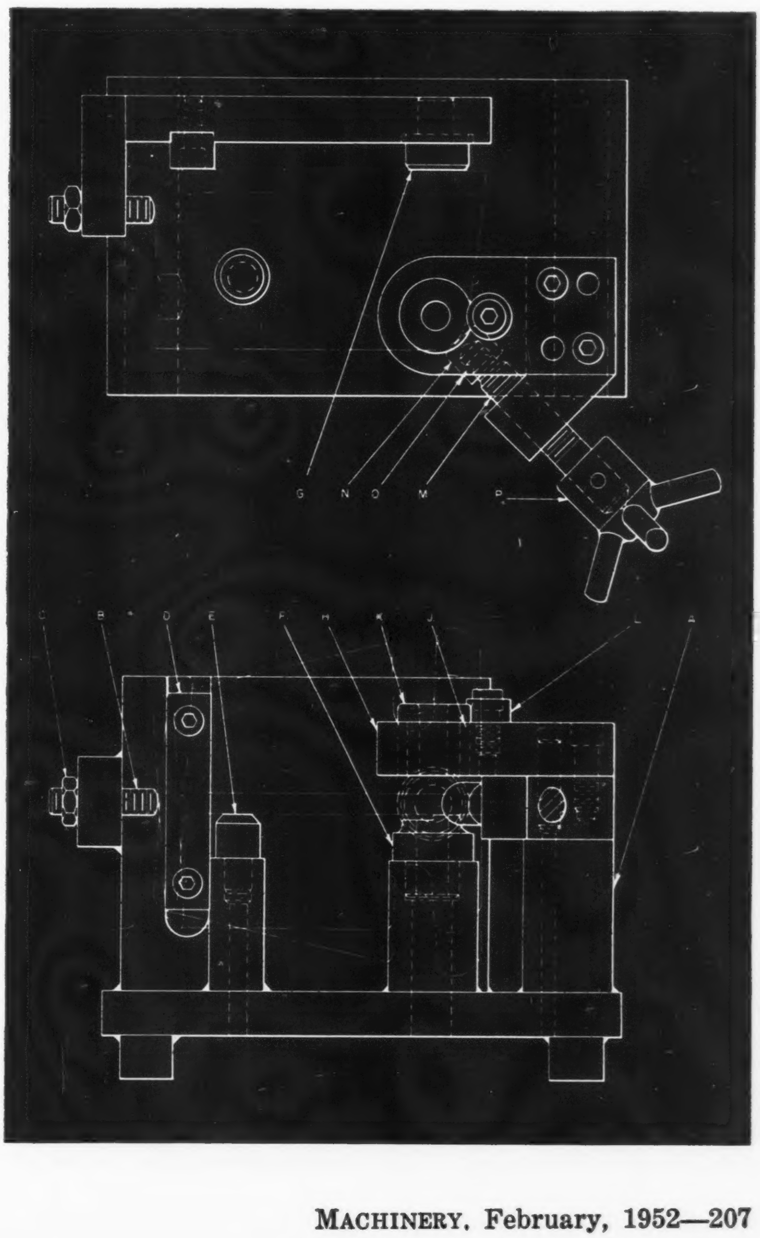
When a work-piece can be located in a jig or fixture from previously machined surfaces, positive contacts can be employed in locating. However, if the work-piece is a rough casting or forging, the locating surfaces or pins in the jig must be made adjustable to accommodate variations in the shape of the parts. An excellent example of an adjustable drill jig is seen in the accompanying illustration.

The work-pieces, as indicated by broken lines, are right- and left-hand brackets for folding-top power units used on Studebaker automobiles. The only machining operation required on these malleable castings is the drilling of a 25/64-inch diameter hole in each part.

Screwed into the left-hand end of the welded drill jig base *A* is a headless set-screw *B*. This screw can be adjusted to suit variations in the castings, and is locked in place by nut *C*. Secured in a slot in the rear wall of the jig base is a locating block *D*. A shouldered work-rest pin *E* is pressed into a vertical post on the jig base. Another vertical post on the base holds a second rest-pin *F*. Positioning plug *G* is pressed into the rear wall of the base.

The bushing plate *H* is secured to the top of a vertical projection at the right-hand end of the jig base. Inserted in liner bushing *J* in this plate is a slip drill bushing *K*, which is prevented from rotating and being lifted with the drill by clamp *L*. Screw *M* is threaded through an angular projection on the jig base directly below the bushing plate. One end of this screw is reduced in diameter to accommodate a loose fitting, work-clamping plug *N*, which is prevented from dropping off the plug by a pin *O*. A four-pin hand-knob *P* is pinned to the opposite end of the screw.

With a work-piece resting on pins *E* and *F*, knob *P* is rotated to bring plug *N* in contact with the work. This movement forces the casting against set-screw *B*, block *D*, and plug *G*, and thus locates it for the drilling operation.



Jig employed for drilling both left- and right-hand bracket castings that have not been machined previously. Screw (B) can be adjusted to take care of variations in the shape of the castings

* * *

A light-weight gyro compass that will withstand rough treatment has been built by the Arma Corporation, Brooklyn, N. Y., for the United States Army Corps for Engineers. The new compass weighs 67 pounds, compared with 550 pounds for the old model. The compass is said to be simple to operate, well protected, and able to stand up while mounted in tanks.

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester and Silver
Sales Management Engineers
New York and Philadelphia

The Barrel that Came over in the "Mayflower"

RECENTLY I asked the president of a machine building company, "What are your plans for the future?"

"We have two phases to our planning," he replied. "One is how best to produce the large orders we have on our books—that's present-day planning. The other is how to prepare for the time surely coming when the whole market will change. Then we will need improved equipment to sell, additional features suited to changed markets, more economical manufacturing methods, machines that will be salable when inquiries are scarce and selling is hard."

In the same way, each of us as sales engineers must plan for the present and also for the future. Naturally, we are most concerned with the immediate problems confronting us. But are we also thinking of the future and considering what we will do when the entire customer picture is not painted in bright colors, but in drab and perhaps faint tones?

Business in our industry moves according to cycles, and the sine wave has steep peaks and almost bottomless furrows. As we travel on the mountain tops, we often overlook the valleys that lie between us and the distant high land. Without planning, we are likely to get lost in the morass as we drop to lower ground and lose our view.

An Old New England character claimed to have a barrel that came over in the "Mayflower." As tourists chanced to visit his village, he struck on the idea of setting the barrel up in his woodshed, and putting a sign on the roadway inviting travelers to inspect it for a fee of 10 cents.

The first customer stopped his car, paid a dime and entered the woodshed. Stooping over, he inspected the barrel through his glasses. "Ugh," he said, "the staves look rather new." Then, moving his head, "The ends don't appear old. And look at the hoops. They're made of shining strap steel.

"It's a fake!" he exclaimed. "What's old about it?"

Then the owner quietly explained. "The staves fell apart; so we renewed them. Also, the ends sluffed away and needed repair. The straps rusted and broke—so we put on new ones. But the bung-hole is there, just exactly the same. No barrel's any good without a bung-hole!"

Just so with selling. Old ideas must be discarded and new ones substituted, but we must have the same ability to convey ideas and receive them—like the old bung-hole in the barrel.

What shape must our present sales planning take to meet a future buyer's market?

1. Get a sense of proportion. Innumerable salesmen think and act as if present conditions will always exist. They are the ones who are "riding the sky" and are due later for a fall.

2. Try to retain enthusiasm. Approach each present-day prospect with intelligence, persistence, and enthusiasm; otherwise the art of selling with be lost. That art—though with changed techniques—will be needed in the future as the prospect's wants change.

3. Center present selling methods on good will and service, even to the extent perhaps, of helping the prospect get more out of competitive equipment, the like of which we cannot supply. In so doing, we can build a superlative reputation of serving the customer's interests, which no one can steal from us.

4. Note carefully the prospect's reactions and adjust your approach. This gives us valuable training, and instills in us habits of great value later. Prospects' buying motives change, but the ability to meet them, and the necessary will and courage, are elements that apply both in good times and in bad.

5. Develop new ideas in selling. Inventive skill is inherent in the forward-looking engineer. This skill is developed by devising a new response to the changed buying motives of the prospect. Let's extend our skill in the realm of methods of appeal.

6. Learn what your prospect's plans are to meet a future lean market. "What are you thinking about doing after your flood of orders subsides, Mr. Prospect? Let me help you in your planning to produce cheaply and well what you have in mind."

Remember the barrel that came over in the "Mayflower"—it's not what the barrel is, but what it will do. Perhaps even the barrel exhibited will eventually be a steel drum. But it will still have the same old bung-hole. So persistence, courage, and enthusiasm in communicating ideas —a way to get in and out—must still remain unchanged in our selling.

* * *

Analysis of Metals by Spectrometry

Fluorescent X-ray spectrometry, now used in the routine analysis of metals, is far more rapid than the usual chemical techniques. By this method, for example, five elements in a gas-turbine bucket alloy can be determined in thirty minutes—an analysis that normally requires eight hours by chemical methods.

A recent development announced by the General Electric Co. is the use of a direct-reading spectrometer to determine the composition of alloys used to produce Alnico permanent magnets. The instrument gives a complete analysis of these eight-element alloys in less than three minutes—compared with several hours using the wet-chemistry method.

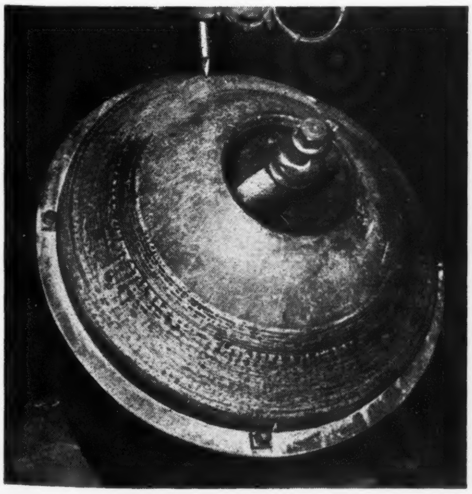
Crusher Parts Made Tougher by Unionmelt Process

Manganese crusher cones and mantles rebuilt and hard-surfaced by the Unionmelt process in the plant of the Finning Tractor and Equipment Company, Ltd., of Vancouver, Canada, have been found to outlast the original parts. The results proved so successful that the process is now being applied to new units as well as old. The hard-faced parts have 50 per cent longer life than unprocessed parts, and inspection after service reveals little or no deterioration of the hard-faced surface.

New cones and mantles are surfaced by applying a special hard-facing underlay first, and then overlaying with hard-facing rod. For units that have been in service, a preliminary build-up of manganese steel may be required prior to depositing the special hard-facing underlay. If the unit is worn more than 1/2 inch, reclamation is not attempted.

The crusher part is first given a preheat at a temperature of 150 to 200 degrees F. in accordance with standard practice. During welding, the temperature of the part is kept below 500 degrees F. at all times. Prolonged heating in the neighborhood of 750 degrees F. would result in embrittling the manganese steel.

The application of hard-facing base material to a manganese steel cone prior to final hard-facing is shown in Fig. 1. Unionmelt composition Grade 80 was used, and a welding current of 330 amperes at 30 volts (alternating current), was maintained with welding speeds of 18 inches per minute. Fig. 2 shows the final application of a hard-facing layer on the worn cone surface. Here approximately 70 pounds of underlay and 30 pounds of hard-facing overlay were deposited.



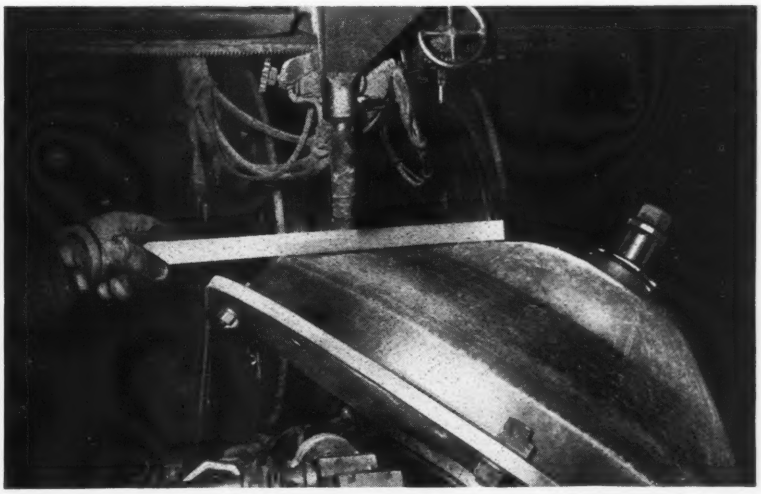


Fig. 1. (Left) First step in hard-facing a manganese steel crusher cone by the Unionmelt process is the application of hard-facing base material. Fig. 2. (Right) The final application of a hard-facing layer is shown here well under way on crusher cone

LATEST DEVELOPMENTS IN *Shop*

Danly Hydraulic Machine Built for Piercing Operations on Jet-Engine Parts

New hydraulically operated automatic piercing machines, the original development work for which was carried out by the Mueller Engineering Co., Dearborn, Mich., are being built by Danly Machine Specialties, Inc., 2100 S. Laramie Ave., Cicero, Ill. The machine shown in Fig. 1 is specifically designed to pierce slots in jet-engine shroud rings, but can also be utilized for piercing holes in such parts as automotive tire rims or other circular work.

Accurate spacing of the pierced holes and consistent production of uniform parts are assured by a unique indexing mechanism. The master index-ring is quickly interchangeable. Precisely located slots in this interchangeable ring accurately control the location of the pierced holes. An index mechanism of this type makes it possible

Fig. 1. Hydraulic piercing machine built by Danly Machine Specialties, Inc., for piercing slots in jet-engine shroud rings

Equipment

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on Market

Edited by FREEMAN C. DUSTON

to vary the spacing between holes or groups of holes as the case may be.

A constant torque is applied to the index-table, which is actuated by means of a hydraulic fluid motor through a speed reducer. The large ring gear used to drive the index-table is actuated by a pinion driven by the speed reducer. The piercing unit, Fig. 3, is of a patented floating type which derives its action through a hydraulic cylinder.

This cylinder, acting as the cross-head slide, has all wear surfaces hardened and ground. Its long guides provide maximum rigidity and, therefore, accurate alignment between punch and die. The cylinder is also equipped with a hydraulic stripping mechanism which eliminates the need for springs and simplifies the changing of tools. The hydraulic system is shown diagrammatically in Fig. 4.

The hydraulically operated C-frame slide keeps the part clear of the die-block during the index cycle, thus preventing marking or marring of the part, as well as wear of the die-block. The part is pinched on both sides during piercing, with equal force on punch and die, so that no distortion of the work occurs.

The machine illustrated has a capacity of 56 tons at a working pressure of 10,000 pounds per square inch. The hydraulic power system is completely free of high-pressure surge shocks due to the unique design of the hydraulic converter. There are no high-pressure controls except the converter itself. All directional controls and pressure relief valves are of standard design, suitable for pressures of either 1000 pounds per square inch for 5000 pounds per square inch operation, or 2000 pounds per square inch for 10,000 pounds per square inch operations.

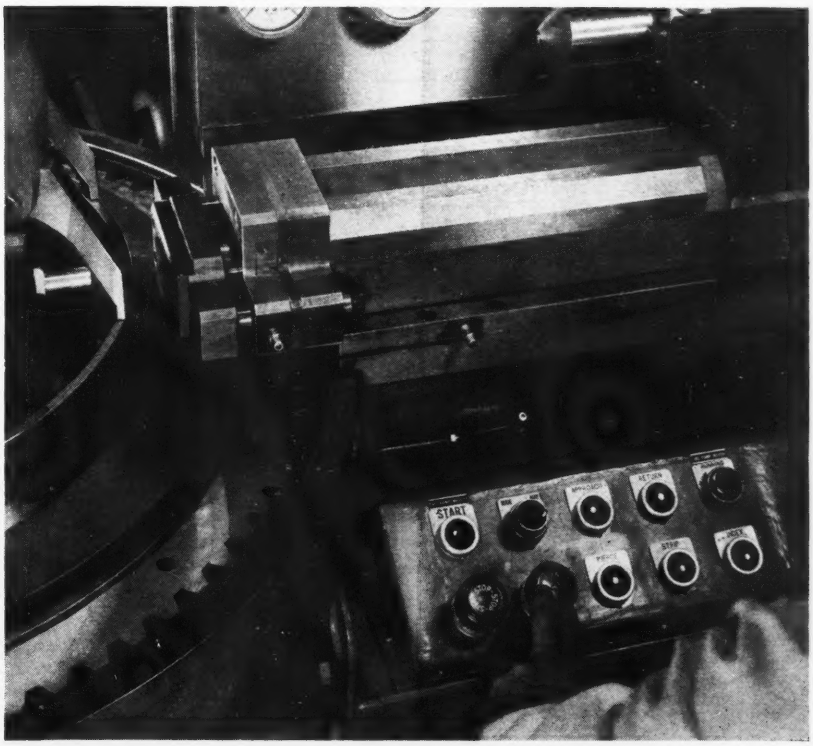


Fig. 2. Operating station of machine shown in Fig. 1, which has fully automatic or manual control

The high-pressure converter is a combination of a continuous booster and a low- and a high-pressure admission valve. The selector spool in the high-pressure admission valve has a built-in decompression spool which prevents the directional spool from shifting until oil under compression has been released. This prevents surge shock from occurring. All hydraulic directional controls, including the converter, are panel-mounted and easily accessible.

The electronic controls, including magnetic starter and line voltage to 110-volt transformer, as well as all control releases, are mounted in an enclosed cabinet. The push-button station, shown in Fig. 2, is conveniently located for the operator, and has all the necessary control buttons to actuate the machine. A selector switch is provided for either automatic or manual operation. The manual operating circuit is for set-up purposes only.

In production, the operator places a part on the locating ring and locks it in place by means of the clamping mechanism; whereupon the automatic cycle is started by means of a momentary contact switch (push-button type). The cycle is as follows: C-frame moves into piercing position until die makes contact with the surface of the part; power cylinder rapidly

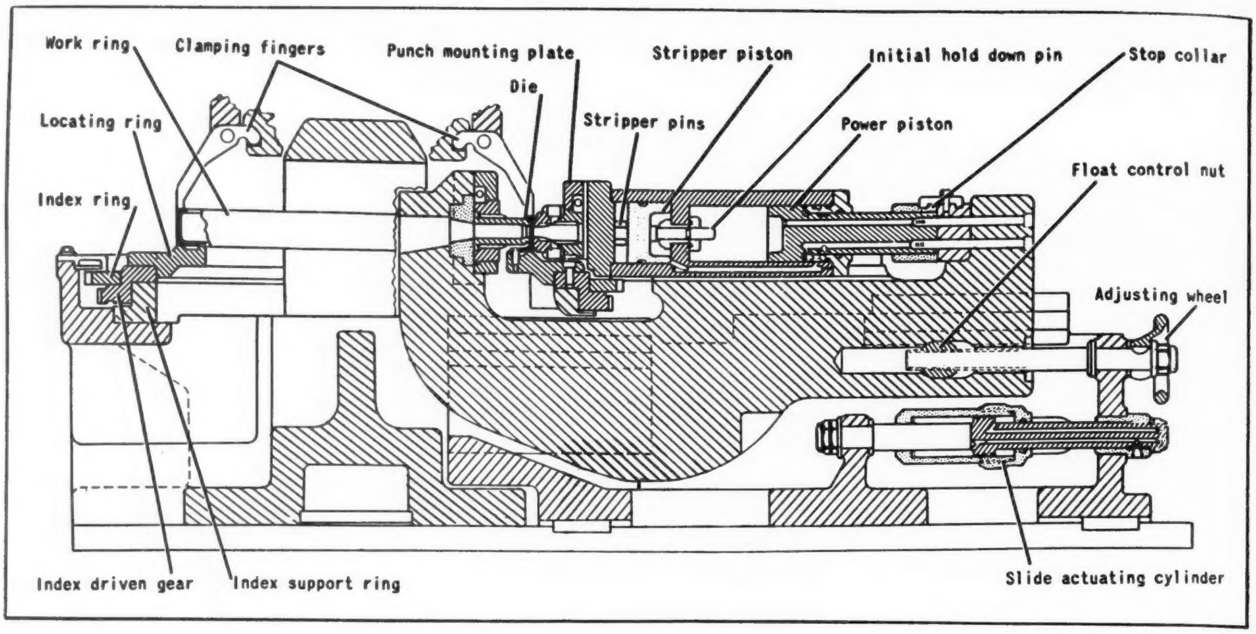


Fig. 3. Sectional view through center of punch and actuating cylinder of machine shown in Fig. 1

approaches under primary fluid pressure until stripper plate contacts part, at which time pressure rise in primary system causes spool of selector valve to shift; instantaneously 5 to 1 ratio continuous booster is actuated, supplying high-pressure fluid for the actual piercing operation.

When the time-control relay "times out," the flow of hydraulic fluid is reversed, causing the punch to withdraw hydraulically and the power cylinder to return to the open position. Simultaneously, the C-frame slide returns to the open position. As soon as the power cylinder has returned, a limit switch is actuated, directing fluid to the locking latch cylinder of the indexing mechanism.

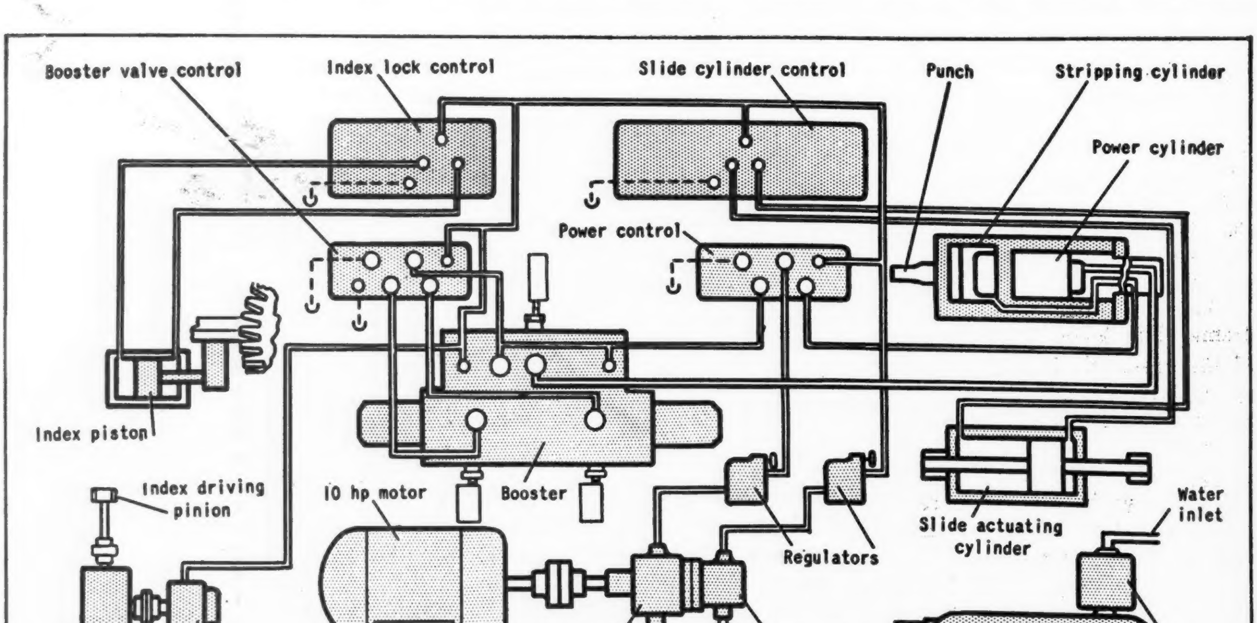


Fig. 4. Hydraulic system of Danly piercing machine, in which special valves and fittings are employed to control the extremely high pressures used. The pressure applied to the punch in piercing the work is a multiple of the primary pressure, and is determined by the characteristics of the booster

The index-table starts rotating as soon as released.

The instant the locking latch reaches its open position, pressure in the actuating cylinder of the locking latch is reversed, causing the index latch to engage the ring in the next notch. As soon as the index latch is in position, a limit switch restarts the piercing cycle.

This sequence of operation continues until the index-table has rotated 360 degrees, at which time the machine comes to a complete stop. The operator then unloads the completed part, and the machine is ready for reloading.

Gay-Lee Commutator Milling Machine

Compactness is a feature of a new commutator under-cutting milling machine brought out by the Gay-Lee Co., Clawson, Mich. This machine has been especially designed for use with carbide tools, and is intended for high-speed production.

Features include high-speed spindle; heavy cast-iron frame; preloaded ball-bearing table with provision for tilting to give better visibility; hardened and ground elevating screw; 1/2-H.P. motor with V-belt drive; and an efficient lubricating system.

Taylor-Winfield Welder for Assembling Jet-Engine Cones

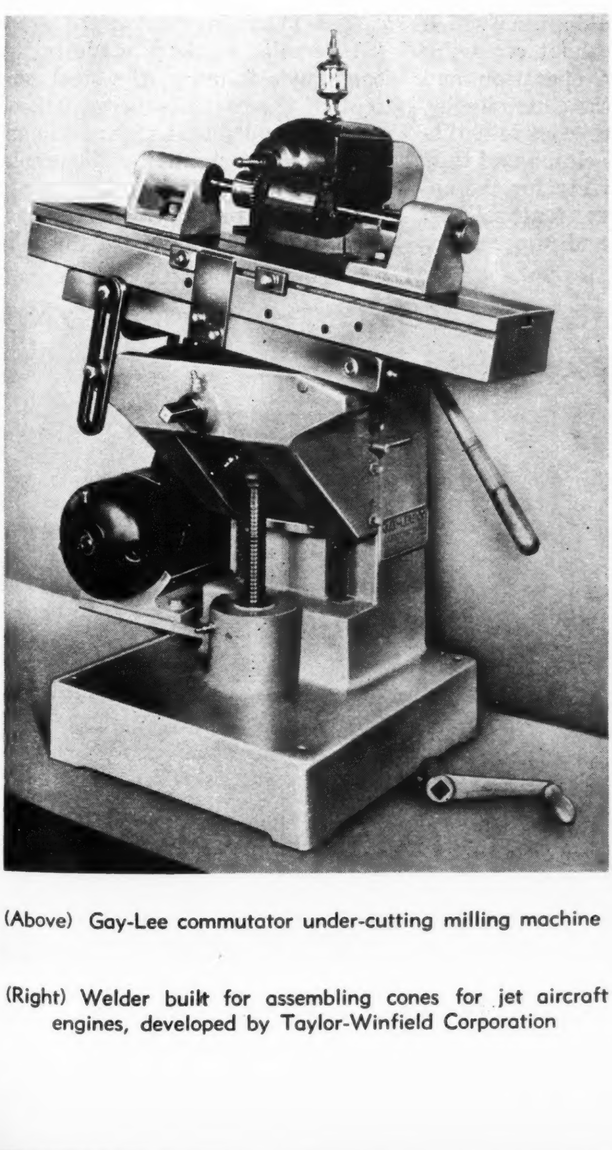
Cone assemblies for jet aircraft engines can now be produced by resistance seam welding in one-tenth the time previously required by the use of a new welder developed by the Taylor-Winfield Corporation, Warren, Ohio. This welder is equipped with a special planetary head, and makes a continuous circular seam weld around individual coupling connections at intervals around the cone.

As each coupling is welded, the assembly is progressively shifted on the clamping die until the next coupling has been brought into line between the welding electrodes. The entire operation is controlled through a foot-pedal.

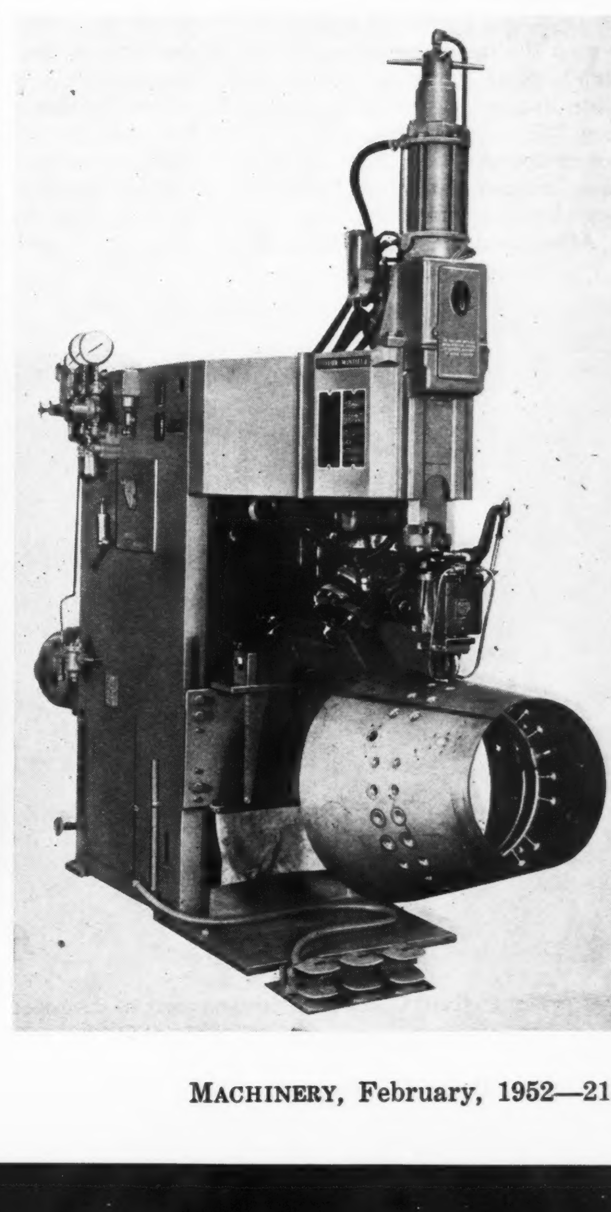
Formerly, this job was handled by a series of spot-welds, which required approximately five minutes per coupling. The same work is now completed in the new welder to military specifications in approximately one-half minute.

Metal-Washing Machine

Four operations—phosphatizing, clear water rinsing, chromic acid bath treating, and drying—are performed on carbon-steel wire frames and metal stampings automatically at the rate of 36 square feet of work per minute in a machine built by the Industrial Washing Machine Corporation, New Brunswick, N. J. This treatment imparts an excellent surface for spray painting.



(Above) Gay-Lee commutator under-cutting milling machine



(Right) Welder built for assembling cones for jet aircraft engines, developed by Taylor-Winfield Corporation

Gardner Clutch-Plate Grinder

The Gardner Machine Co., 414 Gardner St., Beloit, Wis., has developed a double-spindle grinder for wet-grinding parallel sides of steel or bronze-faced clutch plates. This machine will grind plates approximately 0.126 inch thick, having outside diameters ranging from 12 1/2 to 19 inches. The unique features of the machine permit the grinding of work too large in diameter and too thin to be handled on a double-spindle grinder by any of the conventional methods.

The work-pieces are rotated or revolved between two ring type abrasive discs. A heavy cast-iron base supports the grinding head slides on dovetailed, ball-bearing ways. Each head, with its 4-inch spindle, can be tilted, which permits setting the 26-inch diameter abrasive discs at the proper angle for best grinding results.

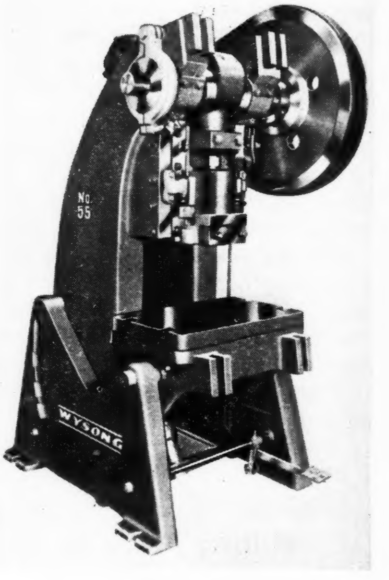
The hydraulically operated, sliding table on which the special work-fixture is carried is mounted at the front of the machine. Three variable-speed grooved rollers riding on the inside periphery of the clutch plate serve to rotate the plate during the grinding operation. Two of these rollers are power-driven; the third is movable, and can be released to permit easy loading and unloading.

After loading the fixture, the operator starts it rotating and advances the hydraulic table until the plate is partially between the abrasive discs. The grinding heads then feed in hydraulically as the plate revolves. When grinding is completed, the heads are retracted, the fixture is withdrawn, and the clutch plate is unloaded.

Production averages thirty-five to forty pieces per hour, 0.010 inch of stock being removed. Tolerances of 0.001 to 0.002 inch for parallelism and 0.005 inch for uniformity are maintained.

Wysong Inclinable Punch Press

The Wysong & Miles Co., Greensboro, N. C., has recently placed on the market a 55-ton, open-back, inclinable punch press. New features claimed for this press include square pin type clutch with three points of engagement; built-in non-repeat unit; hardened tool-steel wear plates for the clutch pin, which can be replaced without removing the flywheel; cam operation and spring loading of the clutch finger, designed to assure complete disengagement of the clutch and thus provide greater safety for the operator. The latter feature also prevents clicking and unnecessary wear of clutch parts. Another feature of the press is the 12-inch die space, measured from bed to slide with stroke down and adjustment up.



Open-back, inclinable punch press brought out by Wysong & Miles Co.

The press is constructed from "Hi-tensile" castings made in the company's foundry, the steel content of the castings being laboratory controlled to insure maximum strength and rigidity. The crankshaft is an alloy-steel forging, mounted in bronze-lined bearings. The standard brake is of the split

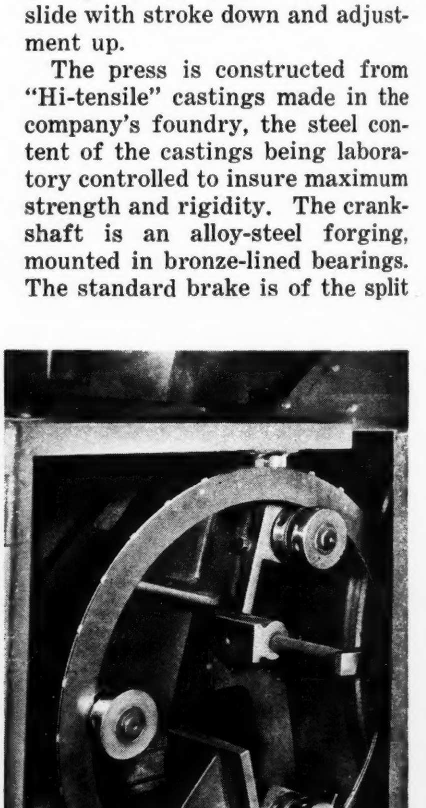


Fig. 1. (Left) Clutch-plate grinding machine developed by Gardner Machine Co. Fig. 2. (Right) Close-up view of clutch plate in grinding position on machine shown in Fig. 1

type with spring tensioner, but an intermittent brake can also be furnished. The slide has a hand-scraped accurately fitted bearing, and is adjustable by means of a ball and socket screw. Knock-out bars are furnished for the slide, and the V-belt drive is standard, but flat-belt, individual motor drive can be supplied.

DoAll "Monolight" instrument for precision measuring with light waves

Buhr Special Machine for High-Speed Processing of Rocker Arms

Extreme rigidity in the central section and utmost safety through automatic shut-off devices are the two prime features incorporated in a special three-way trunnion machine recently announced by the Buhr Machine Tool Co., Ann Arbor, Mich. This machine is designed to process 880 valve rocker arms per hour.

Ten of these machines are being made for one of the large automotive manufacturers, and will be used to process parts for a new overhead-valve high-compression engine. The hydraulic units are equipped with hardened and ground tool-steel ways which are automatically lubricated. Another outstanding feature is automatic clamping and ejection of parts. The machine is basically of welded steel construction, and weighs 65,000 pounds.

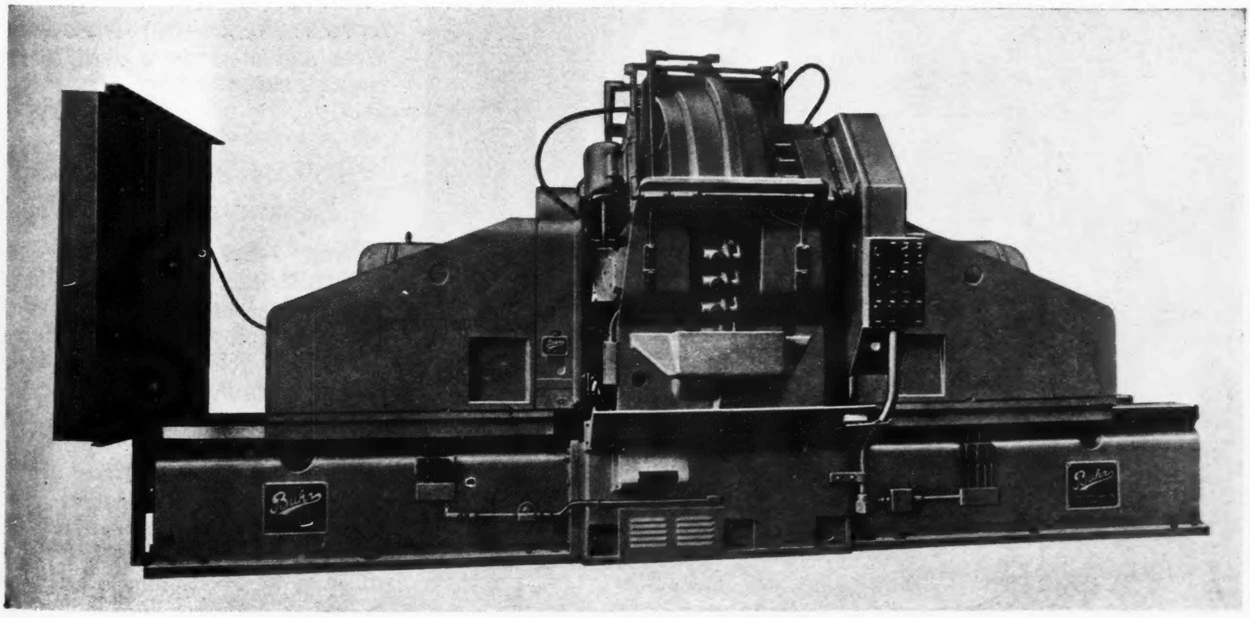
Tooling includes six-station trunnion type fixture, accommodating four parts at each station; power indexing for the trunnion; and twenty-spindle right-hand head, twelve-spindle left-hand head, and four-spindle rear head. Side heads have cluster type construction. Checking spindles are provided for small holes drilled at the rear station. If any small hole at this station is not completed, a light indicates the spindle involved, and the machine is automatically stopped.

New DoAll "Monolight" for Measuring with Light Waves

The DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill., has announced a new monochromatic light, designated the "Monolight," which has ten times the capacity of the previous model. The development of this monochromatic light of greater intensity and size was made necessary by the constant trend toward finer tolerances in size, flatness, and parallelism of production parts.

The new "Monolight" has all the basic design features of the original DoAll model instrument for measuring with light waves. It is a self-contained unit in a light, rigid, cast-aluminum body, having a 5- by 5 1/2-inch high-intensity helium-tube light source which provides 53 foot-candle-power on the testing stage.

The standard stage is a 6 1/8- by 4 1/8-inch phenolic plate, which can, at additional cost, be replaced by a granite surface plate that is lapped to within one wave band of true flatness. Under the hinged work stage there is sufficient storage space for six 2-inch optical flats or three 3- or 4-inch flats. Storage space is also provided for the 5-foot extension cord.



Special trunnion type machine for high-speed processing of valve rocker arms placed on the market by the Buhr Machine Tool Co.

The power supply unit of this instrument is a 7500-volt transformer operating on 110-120-volt 60-cycle alternating current. The helium-tube light source provides extremely accurate interference bands at 0.0000116 inch intervals. When used with accurate optical flats, it can be employed to measure size, flatness, and parallelism to within a few millionths of an inch. To inspect large areas or greater work heights, the head, or light source, can be turned 180 degrees, giving the operator a large free working area.

The instrument weighs 30 pounds. It is 9 1/2 inches high (closed), 8 inches wide, and 11 3/4 inches long. Maximum height from stage to light is 9 inches, and maximum height from table to light is 16 inches. There are various accessories available, including a complete range of gage-blocks and optical flats.

Giant Sellers Boring Mill for Machining Huge Generating Unit Frames in G-E Plant

A Sellers 42-foot vertical boring and turning mill, said to be one of the largest machines of its type ever constructed in this country, has been built by the Consolidated Machine Tool Corporation, Rochester 10, N. Y., for the General Electric Co., Schenectady, N. Y. The table will support a maximum work load of 82 tons.

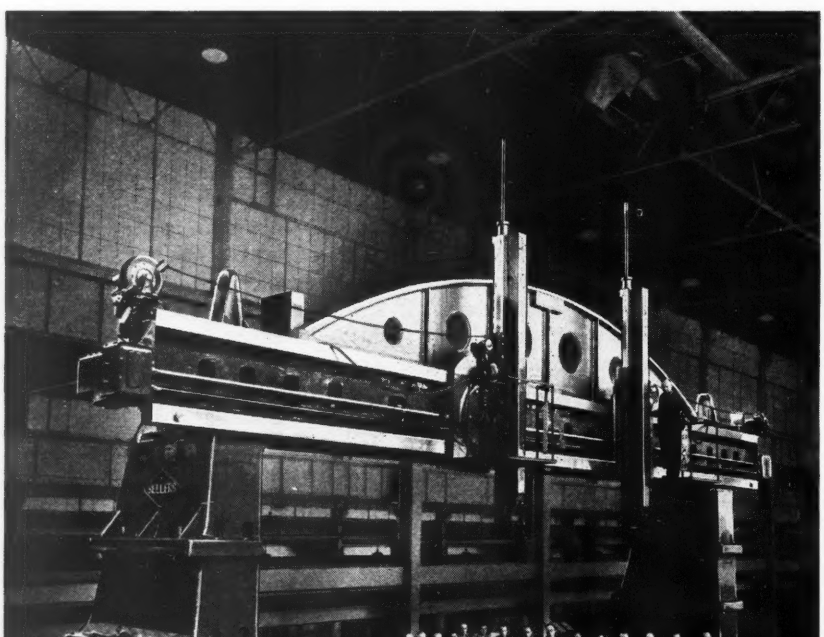
The work is usually held on and rotated by the 20-foot diameter table, the tools being mounted in each of the cross-rail heads, with the cross-rail supported on the block type uprights shown. The maximum height under the cross-rail is 14 feet 6 inches. When occasion requires, the cross-rail and uprights can be moved to the rear to provide an even greater swing than the normal 42 feet.

For handling still larger parts, the cross-rail and uprights can be removed and the work held stationary on the bed and the iron floor plates surrounding the table. With this arrangement, the cutting tools are mounted on stands on the revolving table. Also, a special portable push-button station is plugged into the center of the table, which gives the operator complete control of the machining operations from his position inside the work-piece while riding on the rotating table.

Portable push-button stations, conveniently located, function from the floor or the rail-head platforms for either high or low level work. Speed indicators and horsepower meters are mounted on the machine to give complete and efficient control of the operations and take full advantage of the power available from the 100-H.P. main drive motor.

The table with its driving gear weighs approximately 60 tons, and is centered by large Timken bearings. It runs true within 0.001 inch on circular tracks of laminated phenolic plastic (Formica) manufactured especially for this purpose. These tracks are flooded with oil, so that the surfaces are actually separated by a film of oil at all times. All of the lubricant is filtered before entering any of the machine bearings.

The foundation required for this machine is approximately 60 feet wide and 40 feet deep, front to back. About 1000 tons of concrete and steel were used in its construction.

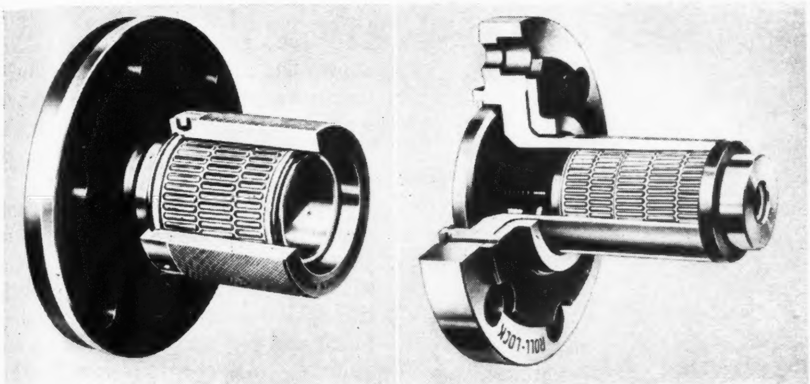


Sellers special vertical boring and turning mill built by Consolidated Machine Tool Corporation for use in machining huge frames and other parts of hydro-electric generating units

"Roll-Lock" Chucks and Expanding Mandrels

Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill., have announced a new line of precision internal and external chucking devices for holding parts and tools during turning, grinding, or inspection operations. These devices, known as "Roll-Lock" mandrels, arbors, and chucks, utilize a new principle that creates an extremely rigid and accurate centering or shrink fit for the transmission of maximum torque and thrust.

For either external or internal chucking, only rolling friction has



"Roll-Lock" flange type chuck and expanding mandrel introduced by Scully-Jones & Co.

to be overcome in tightening or releasing the grip on the work. Very little turning force on the actuating ring or cone causes great holding pressures to be exerted between the "Roll-Lock" chuck or mandrel and the work by the powerful wedging action of the rollers, which expand or compress the chucking surface to a shrink fit. The shrink fit, however, can be quickly disengaged or released by a reverse twist of the actuating ring or cone, although the work cannot be loosened by shock or vibration.

Single-Wing Tangent Bender for Forming Crown, Corners, and Sides of Metal Cabinets

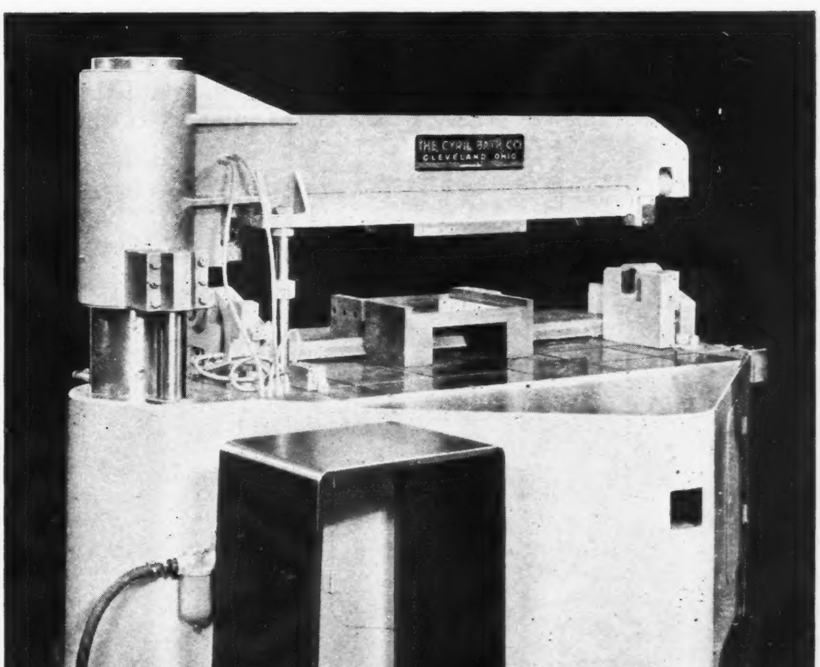
Rapid, accurate forming of metal cabinets and cases having two or four radius-formed corners can be accomplished on the new Model F single-wing tangent bender brought out by the Cyril Bath Co., 6955 Machinery Ave., Cleveland 3, Ohio. This bender has been designed to shape flanged sheets around fixed radius-shaped corners without wrinkling. The open throat has been especially developed to permit fully formed shapes to be removed from the machine easily. The ram is locked to the bed during the last inch of travel, and exerts up to 17 tons of vertical pressure.

Features include automatic positioning of the metal to be formed and close control throughout the entire process, making possible volume production of uniform shapes without wrinkles or deformation. Thus hand finishing is virtually eliminated. In operation, the metal to be formed is positioned on the bed of the machine, which contains the female die. The overhead arm or ram holding the male die moves downward and clamps the material in place. The wing then swings out and upward to effect positive shaping.

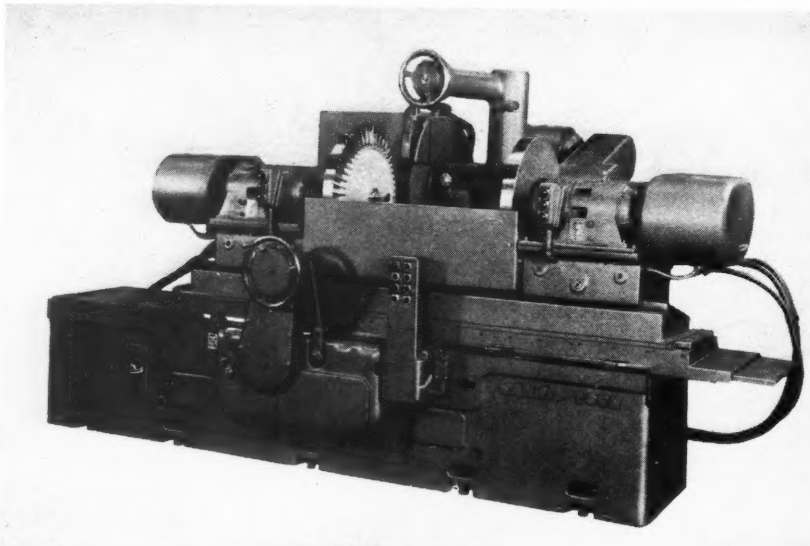
This tangent bender can accomplish any slitting, piercing, stamping, or cutting operation within its capacity while the forming is taking place. It can be varied to accommodate radius-formed corners from 5/8 inch to 5 inches by merely changing the rack and gear mechanism and the male die. All common styles of flanges, as well as standard cabinet sizes, can be readily handled by a single machine of this versatile design.

The new tangent bender is available in three types having die space capacities of 48, 36, and 24 inches. It can be furnished for air or hydraulic operation, and can also be equipped with controls for completely automatic cycling or with separate ram and wing controls for manual operation. Air-operated machines utilize a standard line pressure of 70 pounds per square inch, and require 2 cubic feet of air for each operating cycle.

When the tangent bender is equipped with automatic sequence control, the complete cycle is performed in 4 1/2 seconds. With manual control, the cycle requires 7 1/2 seconds. One operator can produce two-corner cabinets at the rate of seventy per hour with the automatic controls, and sixty per hour with manual operation.



Single-wing tangent bender used in producing metal cabinets built by Cyril Bath Co.



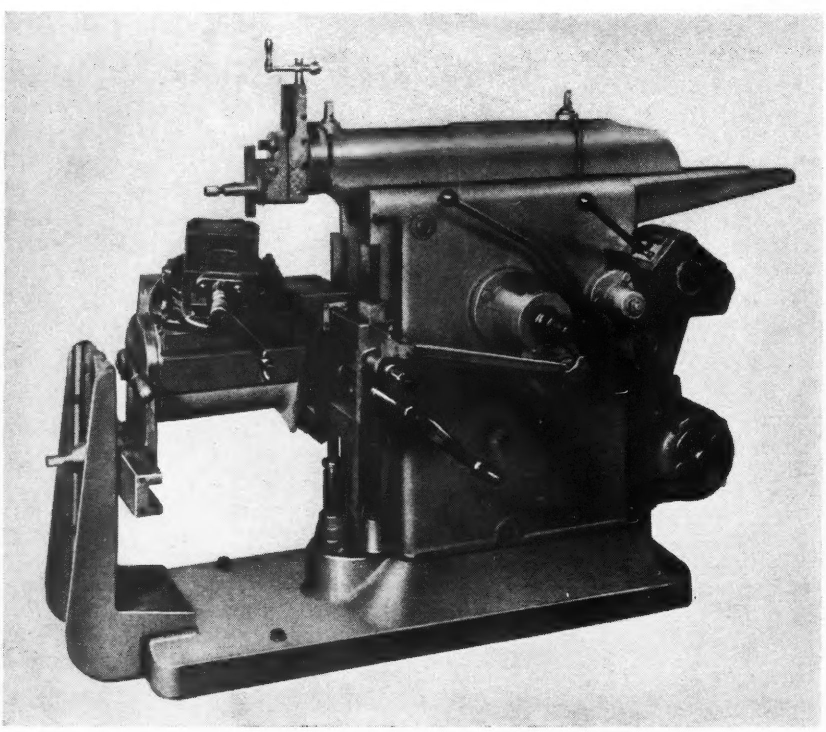
Landis grinding machine with left-hand and right-hand special live-spindle work-heads for rapid grinding of blade tips on jet-engine rotors

Landis Grinder Developed for Grinding Blade Tips of Jet-Engine Rotors

A plain cylindrical grinder designed for high-production grinding of the blade tips of jet-engine rotors has been developed by the Landis Tool Co., Waynesboro, Pa. This 30- by 48-inch Type CHW grinder is equipped with special work-heads. Each headstock has a motor which drives the spindle by means of multiple-vee belts.

The outstanding feature of this precision grinder is the twin headstocks with their hydraulic chucking equipment. With this arrangement, a complete jet rotor can be put in the grinding position on one headstock, while the other rotor with blades is being ground. This operation finish-grinds the tips of the blades to an exact dimension. The accompanying illustration shows the machine with the work-piece mounted on the left-hand work-head for grinding, and the right-hand head ready to be loaded.

When one grinding cycle is complete, the carriage traverses, so that the second head will be in the grinding position. This permits the operator to unload the finished piece and put another rotor on the spindle. All controls are located so that each head can be individually operated. The work-carriage movement is obtained by hydraulic power. Extra wide carriage ways are provided to insure maximum stability in handling work of large diameter. The 30- by 3- by 12-inch grinding wheel is driven by a 15-H.P. motor, the spindle rotating in Landis "Microsphere" spindle bearings.



Brooks high-speed shaping machine introduced in this country by the British Industries Corporation

Brooks High-Speed Shaping Machine

A low-cost, high-speed floor model shaping machine, with swinging table, manufactured by the Newey Engineering Co., Nottingham, England, is being introduced in this country by the British Industries Corporation, International Machinery Division, 164 Duane St., New York 13, N. Y. (Department BR). This machine has a stroke of 18 inches and a 35-inch ram. Four speeds are available, ranging from 22 to 115 strokes per minute.

Both the base and body of the machine are of sturdy cast construction, internally ribbed to insure maximum rigidity. The ram slides are of V-section, with large bearing areas. The automatic horizontal feed motion is arranged to give four variations of feed per ram stroke.

The drive is from a self-contained motor mounted on an adjustable support, and is transmitted by three V-belts through a Matrix multiple-disc friction clutch to a totally enclosed four-speed gear-box. Oil-immersed cast steel gears slide on multi-splined shafts. The bull gear is extremely sturdy, and has helical teeth to prevent chatter and insure a smooth, even drive.

The table surface is 16 1/2 by 11 inches; maximum ram to table distance, 16 inches; longitudinal traverse, 16 inches; vertical trav-

erse, 14 inches; maximum down feed of tool-head, 5 inches; size of vise jaws, 8 inches; vise-jaw opening capacity, 9 inches; size of baseplate, 49 by 21 1/4 inches; and approximate weight, 2000 pounds.

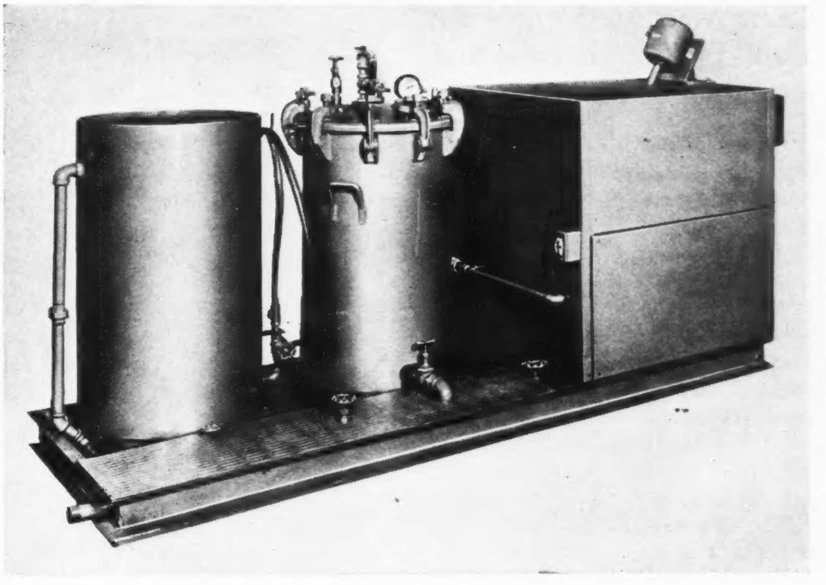
Equipment for Treating Castings to Eliminate Porosity

Elimination of porosity in castings is said to be accomplished rapidly and economically by the use of a new machine called the "Mogullizer" just announced by the Metallizing Co. of America, 3520 W. Carrol Ave., Chicago 24, Ill. This machine is designed to seal both leaking and weeping ferrous and non-ferrous castings under a high vacuum.

Castings to be impregnated must have only minute porosity, fissures or pin-holes. They are placed in the sealing tank of the unit, where they are first subjected to a 29 1/2-inch vacuum for twenty minutes to remove all air and moisture from the inner walls. Next, an impregnating solution, such as the Mogul cast seal colloidal, is introduced into the vacuum tank so that it covers the castings.

This is followed by the application of 100 pounds air pressure for another twenty minutes, the solution being forced into the casting walls from all directions. When the remaining solution is withdrawn, the castings are removed and rinsed in plain water. No further operation is said to be needed for sealing the castings.

Pressure castings sealed by this process are said to have withstood tests with such solutions as hot oil or kerosene under pressures as high as 10,000 pounds per square inch.



"Mogullizer" for sealing castings to eliminate porosity, placed on the market by the Metallizing Co. of America

Simplified Lathe Designed to Produce Fine Finish at High Production Rates

A "Magdeburg" lathe designed to provide high precision and fine finish at rapid production rates is being placed on the market by the Kurt Orban Co., Inc., 21 West St., New York 6, N. Y. Operation of this Type D-30 center lathe is said to be extremely simple for a precision machine. One lever serves to control forward and reverse rotation and speed of spindle, as well as stopping of the spindle. A second lever facilitates the selection of any one of four longitudinal and four facing feeds.

The spindle housing and bed of the lathe are cast in one part. The V-belt drive is designed to eliminate vibration and chatter, and the spindle runs in pressure-lubricated bearings, the end load being taken by thrust bearings. Speeds range from 300 to 3000 R.P.M.

Steel with tensile strengths up to 110,000 pounds per square inch can be cut to a depth of 0.158 inch with a feed of 0.004 inch. Tolerances of plus 0.000 to plus 0.004 inch are maintained, and it is claimed that in air-conditioned rooms, tolerances can be held within limits of plus 0.00000 to plus 0.00008 inch.

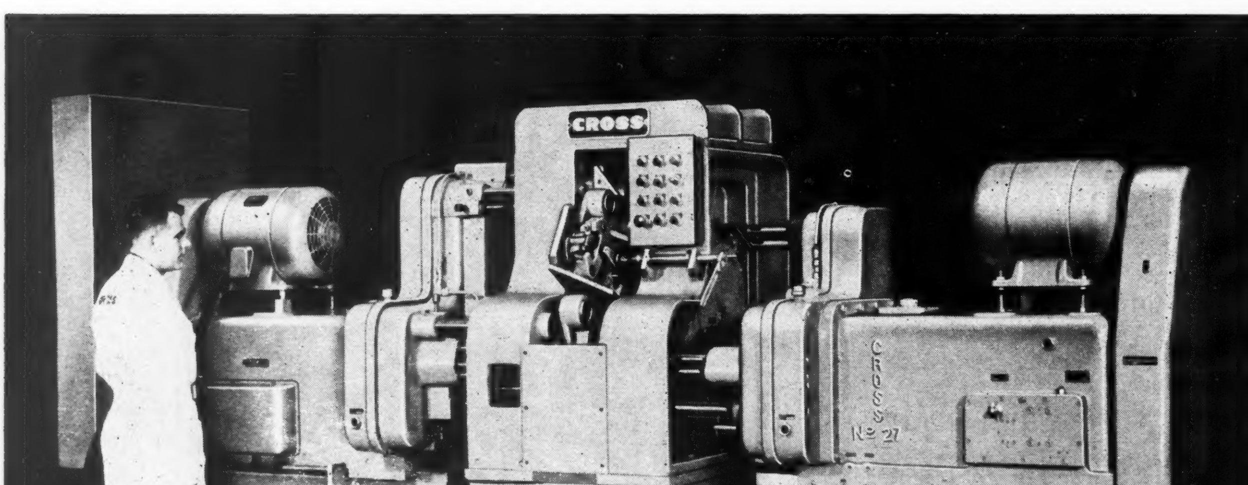
Magdeburg lathe designed for high-precision rapid-production work, **Introduced by Kurt Orban Co., Inc.**

Cross Machine for Boring, Drilling, Chamfering, and Reaming Oil-Pump Bodies

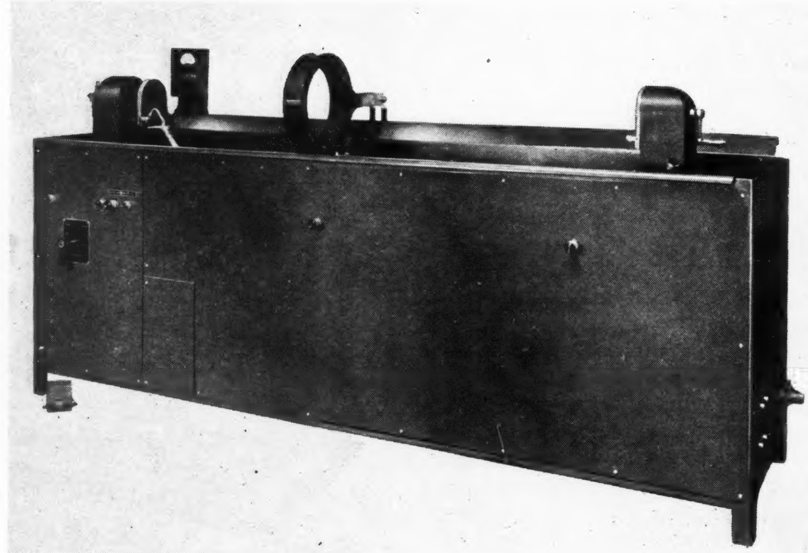
A special machine tool for boring, drilling, chamfering, and reaming oil-pump bodies has recently been designed by The Cross Company, Detroit 7, Mich. With this new machine, only one unskilled operator is required to produce ninety-five pieces per hour. The machine has six stations—one loading and five working, the power-operated trunnion type work-holding table being equipped with a fluid motor drive for quick, precise indexing.

The machine drills and reams the shaft holes, rough and semi-bores the gear pockets and center counterbore, drills the intake hole, and drills and chamfers the screw holes. The front and rear faces of the pump bodies are machined in a previous operation.

Other features of the machine include hydraulic feed, hardened and ground ways, construction according to J.I.C. standards, automatic lubrication, and pre-set tools to speed tool changing and keep "down" time to a minimum. Standard Cross units are used to provide flexibility for part design changes and facilitate maintenance of the machine.



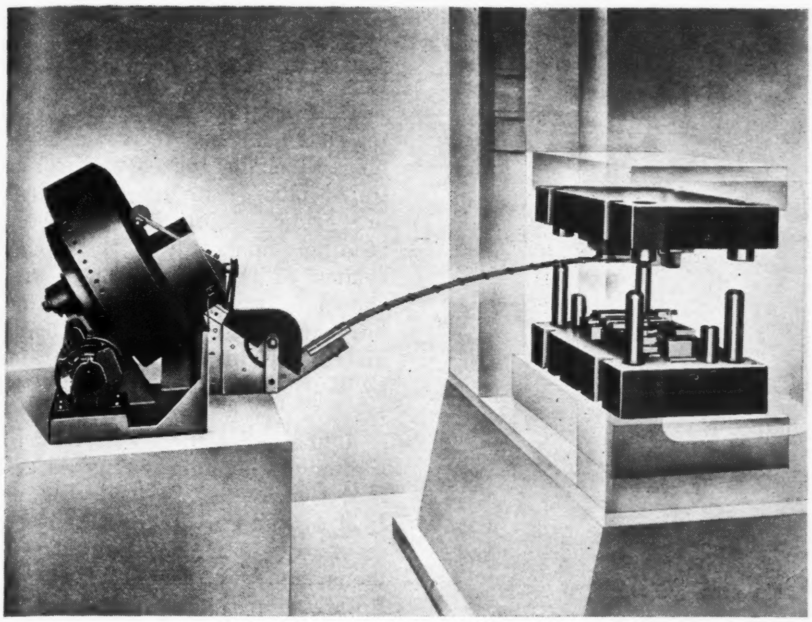
Machine for rapid processing of oil-pump bodies built by The Cross Company


New direct current output Magnaflux unit of integral welded frame and tank construction, with only two front panels attached as separate parts

New Line of Magnaflux Equipment

A new line of Magnaflux non-destructive testing equipment designed for more efficient application of the magnetic-particle inspection method of detecting imperfections in machined parts and raw materials, has been announced by the Magnaflux Corporation, 5900 Northwest Highway, Chicago 31, Ill. In most cases, the new units are larger than the former ones. They are designed to handle a wider variety of parts, and are built for operation on either 220- or 440-volt 60-cycle current.

The direct-current Type ARQ Magnaflux unit shown in the illustration has a maximum head opening of 96 inches; magnetizing current output of 5500 amperes; eight-point current control; tank capacity of 15 gallons; weight of



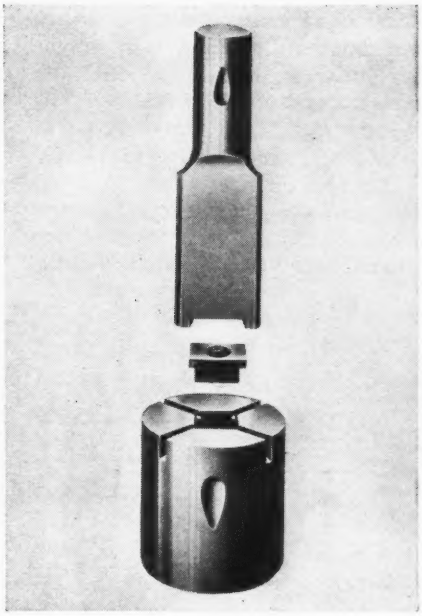


Fig. 1. (Left) Hopper and flexible feed chute which delivers "clinch nuts" to magnetic punch and button die incorporated in a blanking, piercing, and forming die. Fig. 2. (Right) Magnetic punch, "clinch nut," and button die. The nut is installed in metal part with this equipment in one stroke of press

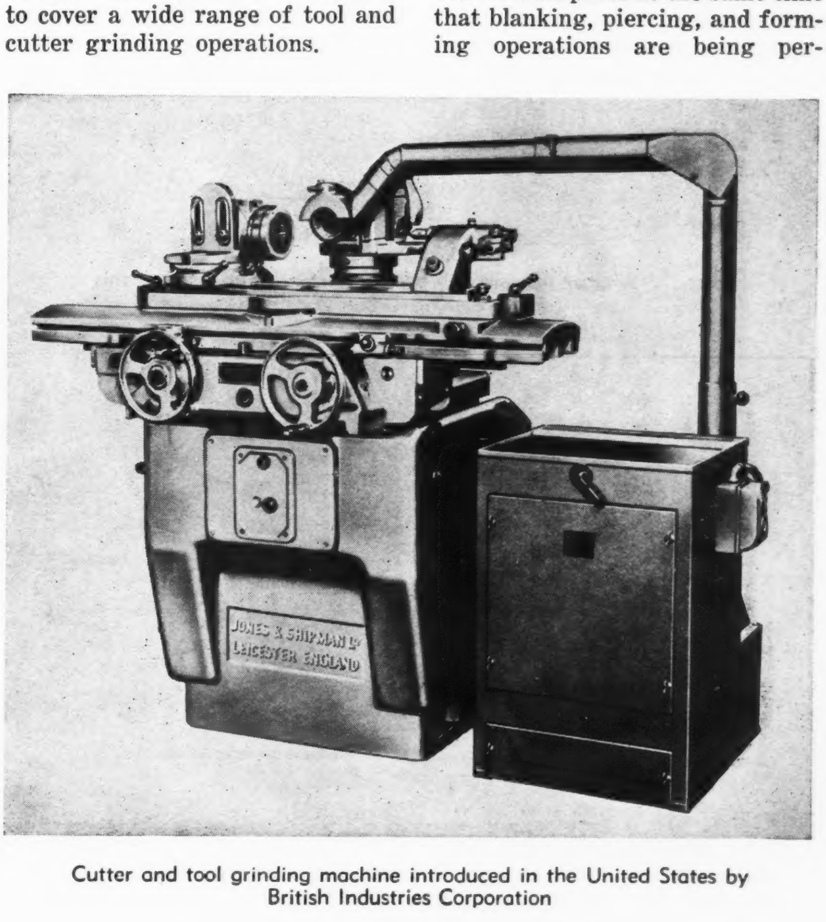
2900 pounds; and over-all floor space dimensions of 42 by 124 inches. Other units of this type are made with head openings of 54 and 144 inches. Alternating-current Type DRC units are made with maximum head openings of 54 and 96 inches.

Cutter and Tool Grinding Machine

British Industries Corporation, 164 Duane St., New York 13, N. Y., representative for Jones & Shipman, Leicester, England, has announced that this company's 8- by 16-inch Model 310 cutter and tool grinding machine is now available for delivery in this country.

This precision cutter and tool grinder has self-contained motor drive with built-in switch gear; universal operating positions with easily accessible controls; anti-friction cross-saddle mounting, designed to insure very sensitive control to cross-feed movements; and table that traverses on precision roller chains.

The table swivels a full 90 degrees in the left-hand direction and 45 degrees in the right-hand direction. The table dogs are reversible. One of these is of the end spring-loaded type, while the other is of the "dead stop" design. The large-diameter wheel-spindle is mounted in specially selected preloaded combined journal and thrust bearings. Universal cutter-head adjustment provides a swing capacity for handling work fiom 8 to 12 inches in diameter. The cutter-head and tailstock have clearance-angle setting adjustments. Attachments are available to cover a wide range of tool and cutter grinding operations.



Cutter and tool grinding machine introduced in the United States by British Industries Corporation

Hopper-Fed "Clinch Nut" Punch and Die Button Unit

"Clinch nuts," which serve as substitutes for welded nuts or tapped holes, can be clinched to sheet-metal parts at the same time that blanking, piercing, and forming operations are being per-

formed by a new magnetic punch and button die unit which can be incorporated in the production die as a normal piercing station. The "clinch nuts" are fed to this station from a hopper (Fig. 1).

As a nut arrives at the piercing station from the hopper, it is held magnetically to the bottom of the punch. On the down stroke of the press ram, the nut, itself, does the piercing; the slug falls through the die while lips on the die button clinch the nut to the under side of the part. Richard Brothers Division, Allied Products Corporation, 1560 E. Milwaukee, Detroit 11, Mich., manufactures these punches, die buttons, hoppers, and flexible chutes.

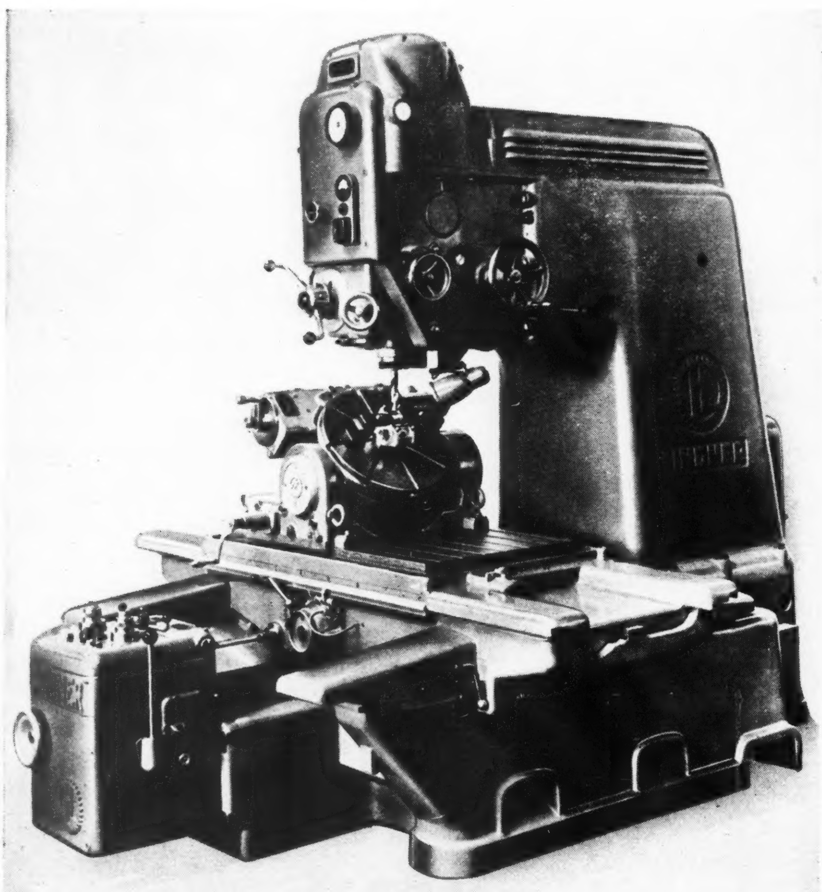


Fig. 1. Lindner precision jig boring machine introduced in this country by Kurt Orban Co., Inc.

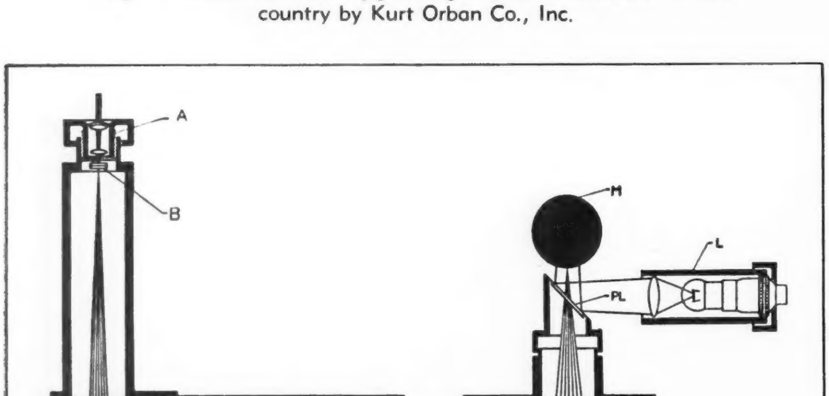


Fig. 2. Optical system employed in Lindner jig boring machine for reading precision scales for both horizontal and transverse movements of table

Lindner Jig Borer with Optical Measuring System

Table settings that are accurate to within 0.00032 inch and bored holes precision spaced within limits of plus or minus 0.0004 inch are made possible by the direct-reading micro-optical measuring system of the Lindner jig borer shown in Fig. 1. This machine, built in Germany, is now being distributed in the United States by Kurt Orban Co., Inc., 205 E. 42nd St., New York 17, N. Y.

A fine helical line, inscribed by a diamond on mirror-finished cylinders, provides the basis for optical reading of the fine adjustments of both longitudinal and transverse movements of the table. Rotatable cylinders connected to the coordinate slides enable intermediate measurements from thread to thread to be made on an annular scale to plus or minus 0.00004 inch, taking readings through the microscope. The accuracy of adjustment is maintained throughout the life of the machine, since there is no mechanical wear in the measuring system.

The optical measuring system is shown diagrammatically in Fig. 2. In this system, the operator reads the scale through eyepiece *A*. For easy reading, scale *M* is illuminated by light source *L* through the plane glass *PL*. The path of the light beam is deflected through prism P_1, passes through lenses L_1 and L_2, and is again deflected through prism P_2 to reticule *B*.

Single column design and sturdy, open construction make the jig borer adaptable to precision boring of bulky work-pieces, as well as heavy roughing operations, without affecting the accurate adjustment of the machine. Infinitely variable spindle speeds within the range of from 50 to 1900 R.P.M. are available in the Model 15 jig borer shown in Fig. 1. A smaller No. 14 jig borer, which has a spindle speed range of 70 to 2000 R.P.M., is also available.

The Model 15 machine has a longitudinal table movement of 40 inches and a transverse movement of 24 inches. The distance between table surface and boring spindle is 10 inches minimum and 30 inches maximum in regular models, but special designs can be built with the maximum distance increased to 34 to 38 inches. The

Model 14 machine has a longitudinal table movement of 24 inches and a transverse movement of 16 inches. The distance between table surface and boring spindle can be adjusted from 3.2 to 21.6 inches.

The external scale with adjustable pointers is shown in the close-up view, Fig. 3. Below the scale is seen the graduated drum with vernier for adjusting the fine scale. Illumination is provided for the drum scale. The ball-handled lever is used for locking the table. The apertures shown at the right and left of the drum are components of the optical-scale reading microscopes.

The aligning of precision work relative to a machined surface or face for accurate boring is simplified by the use of the attachment shown in Fig. 4. This attachment can also be used for aligning bores and external diameters with the boring spindle.

Horizontal and tilting type circular indexing tables are available. The tilting table shown on the machine in Fig. 1 has a diameter of about 17 inches. The corresponding horizontal table has a diameter of about 23 1/2 inches.

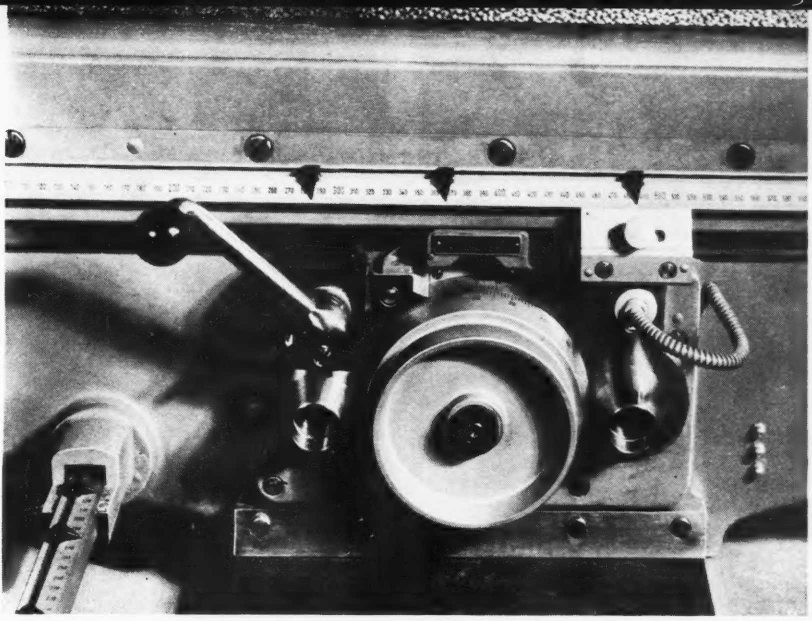


Fig. 3. Close-up view of external coarse scale with adjustable pointers, and graduated drum with vernier for adjusting the fine scale on jig borer

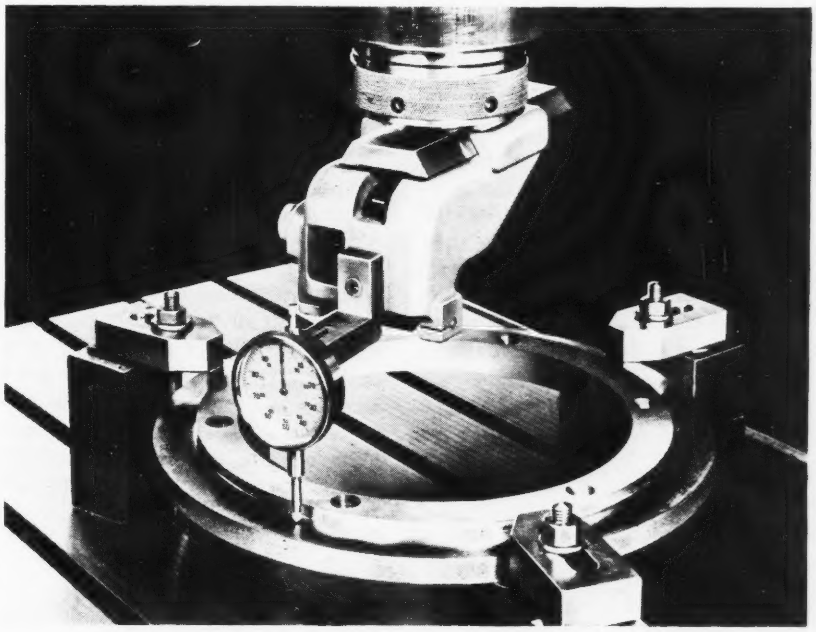


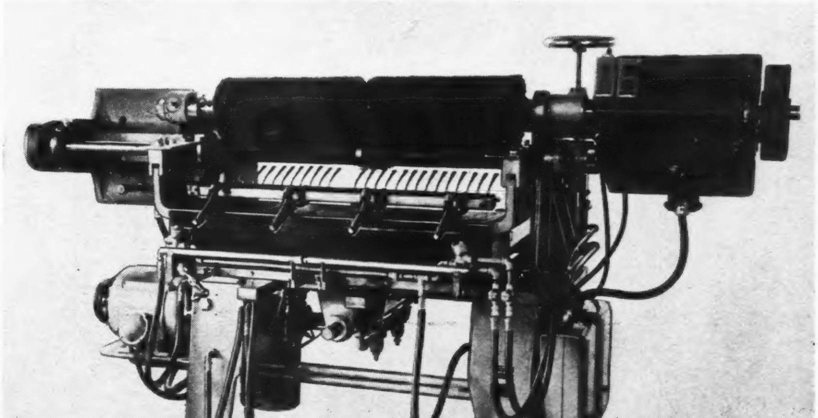
Fig. 4. Fixture used on Lindner jig borer for accurate aligning of work in precision boring operations

Clair Surface Finishing Machine

A new development in buffing and polishing machines designed to eliminate many time-consuming operations has been announced by the Clair Mfg. Co., 1029 S. Union St., Olean, N. Y. Although the machine shown was developed specifically for use in the manufacture of silverware, it can be applied to other types of work.

The outstanding feature of this machine is the provision for holding batches of work in such a manner that they can be transferred as units from one holding rack to another. Thus, practically all the surfaces of many products can be finished in batch lots with only one handling of the individual pieces for the different buffing and polishing operations required.

The standard machine is built with a safety bar across the front which provides for instantaneous opening of the rolls or buffs for loading or for emergencies. One of many optional features is a control that opens the rolls and stops all polishing or buffing action at any predetermined number of strokes from 1 to 400.



Clair surface finishing machine for production polishing of small parts

Rotary rod and tube straightening machine manufactured by the Mackintosh-Hemphill Co.

Rotary Straighteners for Rods and Tubing

A rotary straightener is now being manufactured by the Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh 3, Pa., for use in the metal-working, electronic, jewelry, instrument, and related industries. This machine is designed to remove waves, bends, and kinks from cut lengths of rod 1/16 inch in diameter or thin-wall tubing in sizes up to 1/4 inch outside diameter.

The basic feature of the new Model AYZ straightener, which is the smallest size in a line of twelve machines, is its arrangement of three sets of identically contoured twin cross-rolls, all power-driven. The middle pair of rolls is adjusted up or down, so that the correct amount of offset for straightening is maintained between the horizontal middle roll pass and the horizontal entry and delivery roll passes. Alloy bar stock handled on this machine is said to be held to a straightness specification of 0.005 inch in 2 feet.

Rod or tube is straightened by revolving cut lengths of stock spirally through the three sets of cross-rolls. All six 3/4-inch diameter rolls are angularly adjustable, so that each bears along its whole face on the work. This roll grouping and roll design is said to give two types of straightening action, with straining forces applied over the entire length of rod or tube. Stock lengths as short as 6 inches can be straightened end to end due to the compact design of the machine.

Since this machine requires no guides, cuts or spiral rub marks do not appear on the finished piece. The six driven rolls are actuated by two 1/6-H.P. motors. The operating speed is 100 feet of rod or tube per minute. Full accessibility is secured by three-post construction. The machine is equipped with anti-friction bearings, and is 22 inches wide, 19 inches deep, and 8 inches high.

Furnace for Heat-Treating Small Tools

The Waltz Furnace Co., Department C, 1901 Symmes St., Cincinnati, Ohio, has recently announced an improved heat-treating furnace for small tools. The temperature range of this furnace is broad enough to permit the heat-treatment of all high-speed steels, including the cobalt type.

The unit includes a pre-heat furnace, a drawing furnace, an atmosphere generator, and two quench tanks—one for oil and one for water. The drawing furnace is of the recirculating air type, designed to permit close temperature control in the lower ranges.

Heat-treating furnace announced by the Waltz Furnace Co.

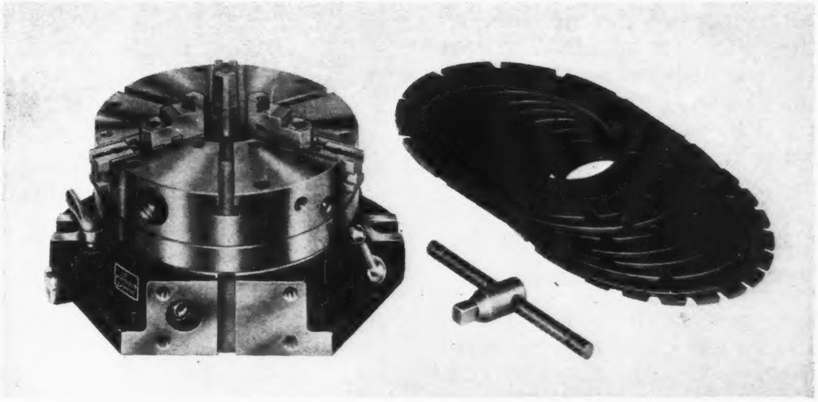
"Super-Spacer" Chuck with Interchangeable Index-Plates

Accurate holding and indexing of a wide range of work for milling, drilling, and checking operations can be accomplished on a 12-inch "Super-Spacer" recently brought out by the Hartford Special Machinery Co., Hartford 12, Conn. The self-centering chuck with reversible top jaws is designed to serve as a combination faceplate and chuck. A through hole allows passage of work up to 4 inches in diameter and permits the use of a centering plug.

Equipment includes a forty-eight-notch master index-plate and a set of eight "Mask Plates" for two, three, four, six, eight, twelve, sixteen, and twenty-four divisions. Special index or "Mask Plates" can be provided for any number

of divisions from two to fifty-four. The turret is also graduated in degrees for use in making odd spacing settings or for checking.

The base of the new spacer is machined to take the manufacturer's standard drilling attachment, which has provision for holding and locating drill bushings as required for circle and layout drilling of holes. The spacer can also be provided with an angle-plate to accommodate work that must be held horizontally.


Hartford "Super-Spacer" chuck with interchangeable index-plates

Cooley Electric Box Furnace

The Cooley Electric Mfg. Corporation, 38 S. Shelby St., Indianapolis 7, Ind., has recently added a larger size (Type BL) electric box furnace to its line. This furnace has a chamber size of 15 by 12 inches by 30 inches.

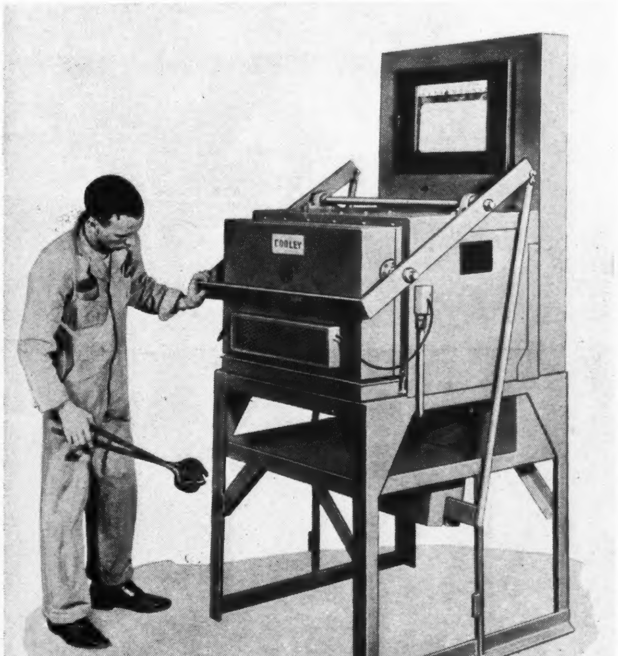
New features of the furnace include embedded type heating unit that protects the heavy element wire from atmospheric attack; elements formed in ceramic slabs, which are located in each side, bottom, top, rear wall, and door of the furnace to give maximum and uniform distribution of heat, and which also act as baffle walls; and unrestricted air spaces which completely surround the elements, providing a natural air convection that further equalizes the temperatures. The furnace is designed for operating temperatures up to 2000 degrees F.

Pullmax Sheet-Steel and Plate Trimmer

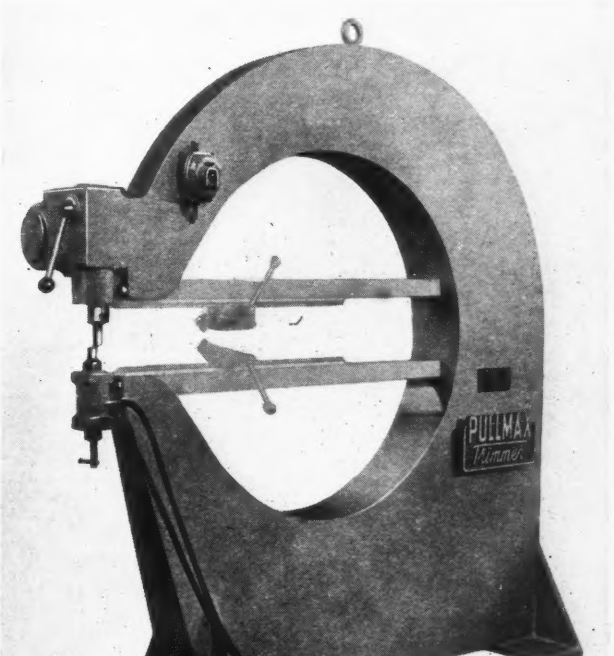
The latest addition to the line of sheet-steel and plate cutting equipment manufactured by the American Pullmax Co., 2455 N. Sheffield Ave., Chicago 14, Ill., is the trimmer shown in the accompanying illustration. This machine is designed for use in the automotive, aviation, and other industries making metal stampings that are too large and bulky to be handled on the regular Pullmax machines.

The lower tool-holder of the trimmer can be raised and lowered by pneumatic pressure to facilitate inserting the work. Like previous models, the machine will do straight, circle, and irregular cutting. The box construction frame is made circular in shape to provide sufficient clearance for large pieces. The bars that hold circle and straight cutting attachments are removable.

Mild steel up to 5/32 inch thick



Larger size electric box furnace added to line of Cooley Electric Mfg. Corporation



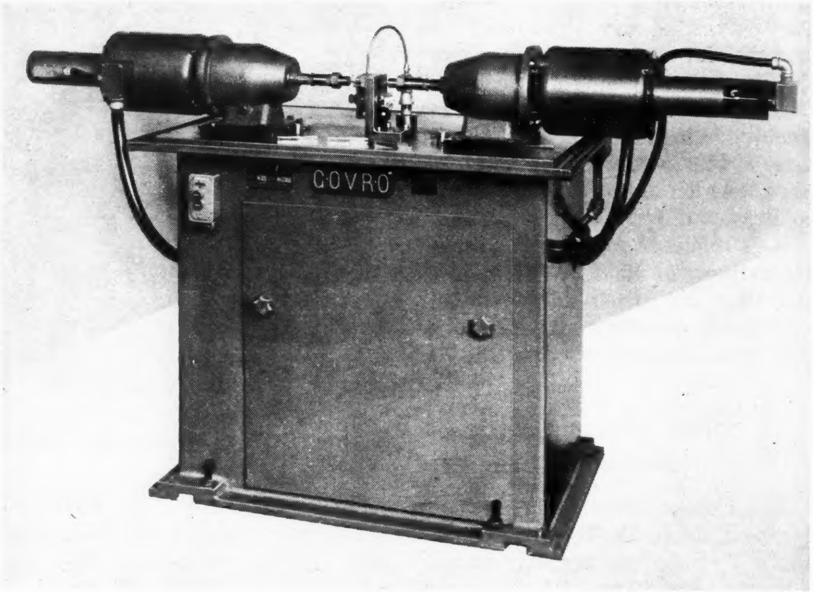
Trimmer for large, bulky metal stampings, manufactured by the American Pullmax Co.

can be trimmed at a speed of from 4 to 16 feet per minute. The trimmer has a throat depth clearance of 48 inches, and is equipped with a 1-H.P. motor. The mechanism is totally enclosed and runs in oil.

Machine for Opposed-Sequence Operations

A new machine for opposed drilling and counterboring operations performed in sequence has recently been announced by the Govro-Nelson Co., 1933 Antoinette, Detroit 8, Mich. The set-up illustrated incorporates two Govro-Nelson Model HH units wired to operate automatically in sequence.

When work is loaded in the fixture and the start button is actuated, one unit drills a hole, or a hole and a counterbore with a combination tool. At the completion of this operation, the second unit comes in from the opposite side and performs a reaming operation. The machine can readily be adapted to various drilling operations.



Govro-Nelson machine built to perform opposed drilling and other machining operations

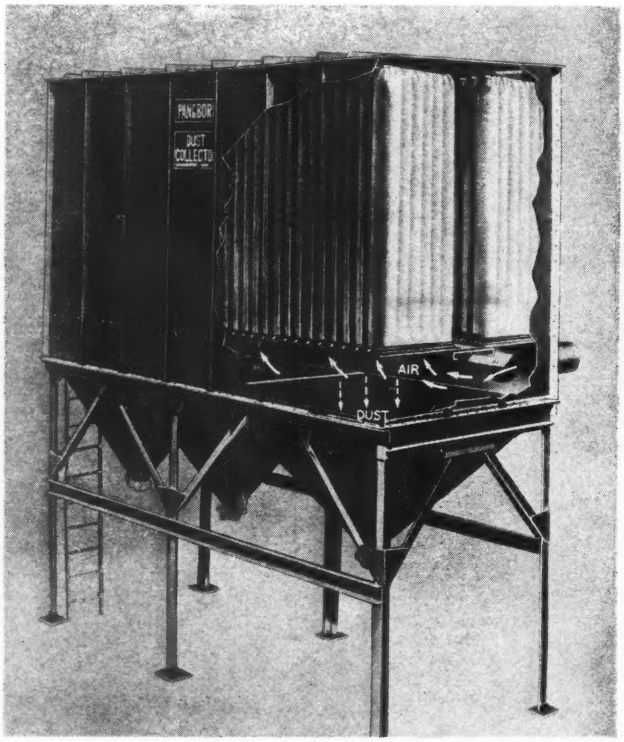
Pangborn Dust Collector

The Pangborn Corporation, 1200 Pangborn Blvd., Hagerstown, Md., has placed on the market a new cloth-bag type dust collector for carbon black, fine wood, graphite, lime, lampblack, metal oxide, and other dusts with similar characteristics. Filter bags and mechanism of simplified design for reclaiming dust from the bags are said to provide economical dust control at low equipment and installation costs.

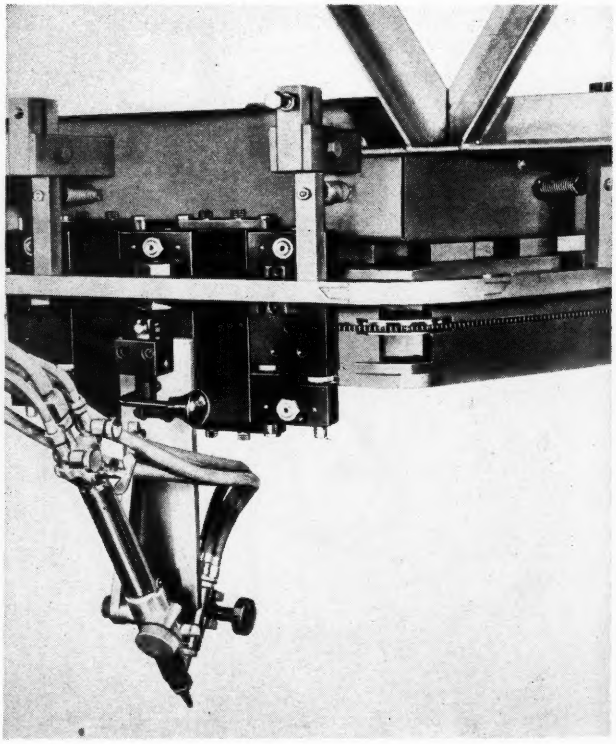
The new cloth-bag dust collectors range from 5 to 40 feet long, contain 1360 to 10,880 square feet of filter cloth, and employ from one to six hoppers.

Oxy-Acetylene Scarfing Machine for Armor Plate

A new armor plate scarfing machine designed to hold tolerances of plus or minus 1/64 inch has been announced by the Cogmatic



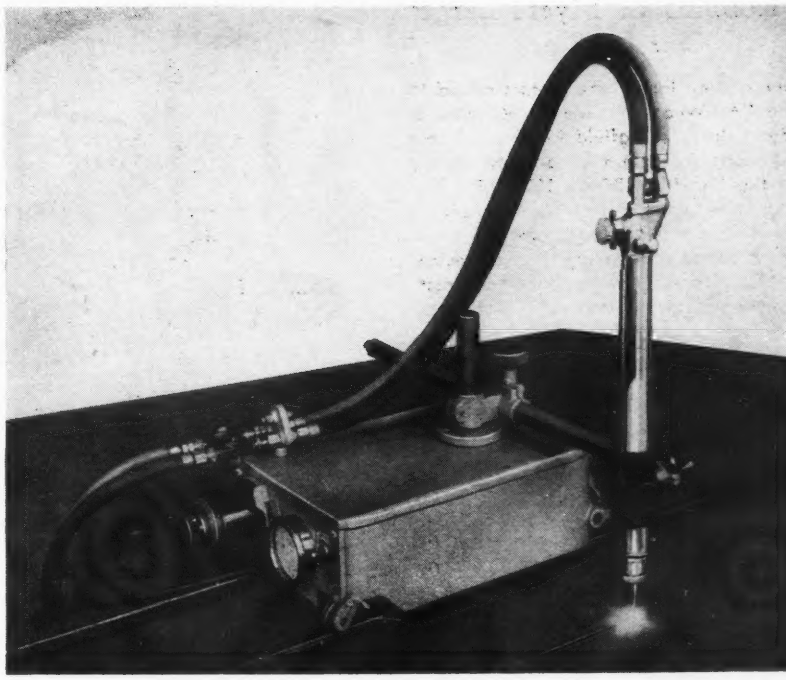
Pangborn dust collector with salvaging feature



Cogmatic oxy-acetylene scarfing machine

Co., 1330 N. Franklin St., Milwaukee 2, Wis. According to the manufacturer, this new machine will precision-trim the edges on double-curved armor plate and effectively prepare welding surfaces to accepted industrial standards. This is accomplished by the use of two oxy-acetylene torches, positioned over the casting by means of a number of articulated sections or "trains" which follow machined tracks.

The torches follow a prescribed path in cutting the castings to the required shape or apex in horizontal or vertical planes and around curves. In some cases, they will cut apexes which diverge from the original plane. Torch movements are effected by a variable-speed transmission through chains which follow the track and are connected to the "trains."



Portable self-contained gas cutting machine placed on the market by the Air Reduction Sales Co.

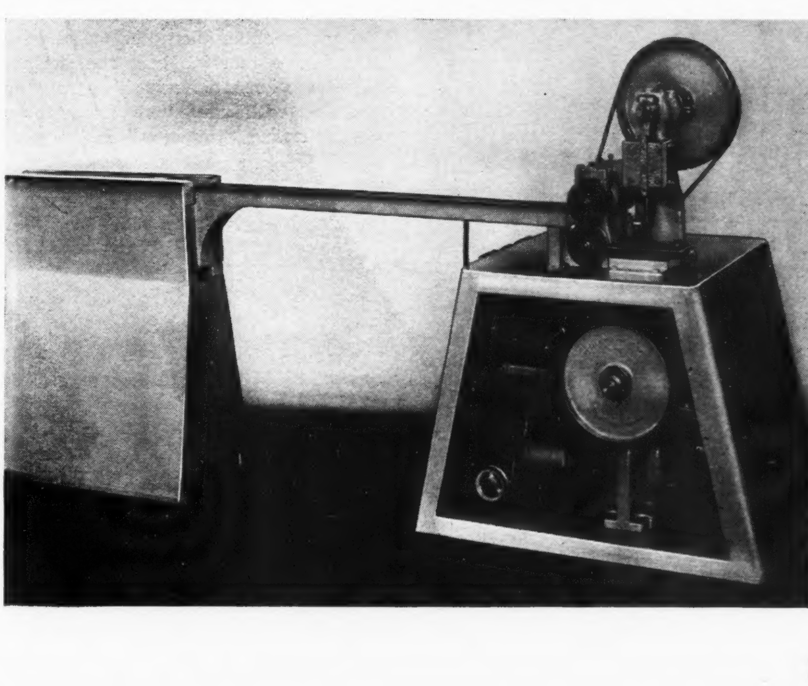
Airco Portable Gas Cutting Machine

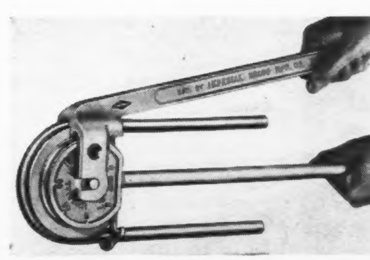
The Air Reduction Sales Co., Division of Air Reduction Co., Inc., 60 E. 42nd St., New York 17, N. Y., has announced a new addition to the Airco line of gas cutting machines, known as the No. 20 Radiagraph. This is the first machine of its type specifically designed to be used as a traveling carriage for such equipment as the "Aircomatic" machine and the Heliweld machine holder, in addition to fulfilling the requirements of a portable, motor-driven, straight track-guided cutting machine.

The transmission is a self-contained unit, with all internal parts easily accessible. Any speed within the operating range can be quickly and accurately set and maintained.

Combination Marking and Cutting-Off Machine

This combination marking and cutting-off machine for tags, plates, etc., consists principally of two Emco presses, manufactured by the Klaas Machine & Mfg. Co., 4330 E. 49th St., Cleveland 25, Ohio. A conveyor feeds the part to be marked to the machine. The work is held by a roll-fed attachment while one press stamps or marks it and the second press cuts off the marked piece.



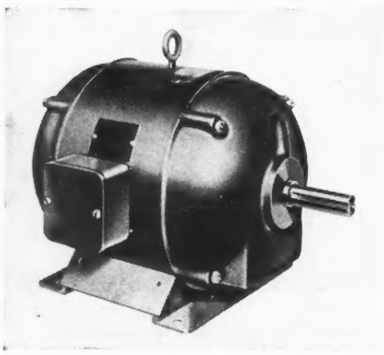


Imperial Tube-Bender

Combination tube-bender that will bend copper, aluminum, brass, and other soft, thin-walled metal tubing of both 1/2 and 5/8 inch outside diameter. A dual size shoe and mandrel make it possible to bend the two different sizes of tubing without changing any parts. The bender is of two-piece construction, and can be quickly taken apart so that it can be slipped over the tube at the point where the bend is needed. Thus it will bend tubing that has one end connected to a fitting as easily as tubing that has both ends free. Bends can be made to any angle up to 180 degrees, calibrations being provided to show the angle of the bend. The bender is a product of Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7, Ill.

Robbins & Myers Large Size Motors

One of four larger size motors added to the "All-Weather" line of Robbins & Myers, Inc., Springfield 99, Ohio. These additions increase the capacity ratings of the line from 50 to 125 H.P. The four new size motors, like others in the line, are subjected to special treatment to resist moisture and corrosion. All steel parts have a baked on, rust-resisting undercoating of "Robinite." The rotor assembly is treated with a special rust inhibitor, and the cast-iron end-heads and terminal box are cleaned and given an anti-corrosion treatment of zinc chromate.

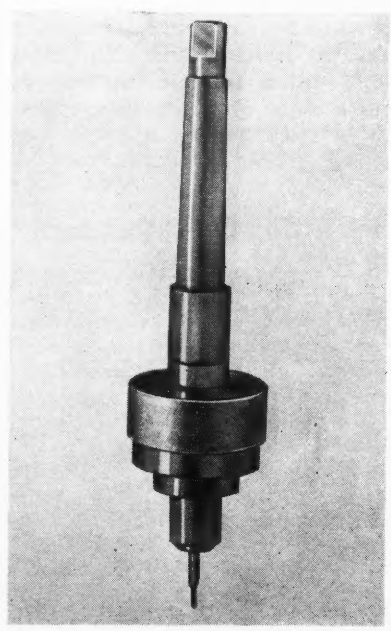


Hand Screwdriver with Removable Insert Bits for Phillips Screws

New type of hand driver with removable, low-cost, interchangeable insert bits for driving screws with Phillips recessed heads. When one bit wears out, it can easily be removed and replaced, making these screwdrivers especially useful on factory production lines. There are four different sizes of Phillips bits, but the No. 2 size insert bit will drive from 75 to 80 per cent of all screws with Phillips recessed type heads. The Continental Screw Co., manufacturer of Holtite-Phillips screws, is sales agent for these new drivers and insert bits, which are made by its subsidiary, the Hy-Pro Tool Co., New Bedford, Mass.

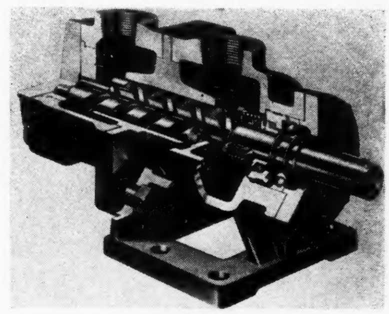
Millers Falls Industrial Sander

Compact sander weighing only 7 1/2 pounds, with ample power and capacity for continuous production. In addition to driving standard accessories, this sander is well adapted for use with the new, high-performance, laminated phenolic grinding wheels and discs. It is suited to the requirements of metal-working and woodworking plants and paint shops for fast sanding, wire-brushing, grinding, and polishing of metal, wood, plastic, concrete and other surfaces. Made by Millers Falls Co., Greenfield, Mass.



Winslow Super-Sensitive Tapping Head

Tapping head embodying new principles of control, designed expressly for high-speed tapping of small holes in sizes from 0-80 to 4-40 in steel or other material. The tapping head is mounted on the spindle of a standard drill press. Provision for vertical travel of the tap is built into the tapping head itself. Control of the operation is through the knurled collar just above the tap. This collar is held lightly by the operator's hand, a light downward pressure being applied to the collar to drive the tap into the work, and a light upward pressure to reverse the tap. The tap can be cleared when necessary by the rapid reverse control. Made by Winslow Product Engineering Corporation, 5420 Jillson St., Los Angeles 22, Calif.

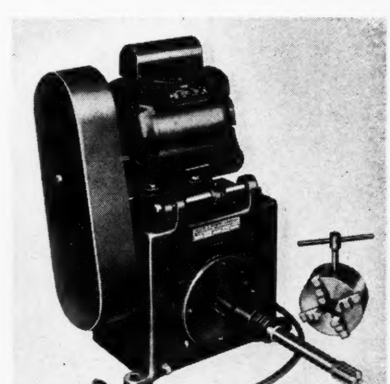


De Laval Rotary Oil-Pump

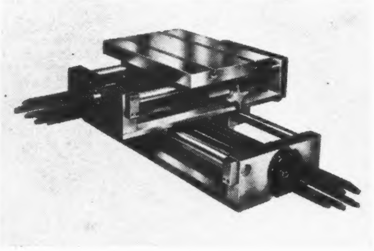
New rotary positive displacement oil-pump having only three moving parts, designed for a wide variety of applications. Features include quiet, pulsation-free operation at high speeds. It has a regular operating capacity of 80 gallons per minute at pressures up to 275 pounds per square inch. For intermittent operations, pressures can be as high as 325 pounds per square inch. The pump will handle light or viscous fluids in hydraulic systems, rotary and steam atomizing oil burners, lubrication and governing systems, etc. Made by De Laval Steam Turbine Co., Trenton 2, N. J.

Portable Power Reaming Machine

Three-speed portable power reamer recently added to the line of heavy-duty production finishing tools manufactured by the Joseph E. Murphy Co., 24 Ellsworth St., Worcester 3, Mass. The Model R machine illustrated is designed for accurate reaming and chamfering. It can also be equipped with a tapping head and with equipment for lapping and honing. A three-step V pulley pro-



vides speeds of 95, 120, and 165 R.P.M. Reamer capacity is up to 1 3/16 inches. The mandrel is bored for a No. 3 Morse taper. Regular equipment includes 1/3-H.P., 110-120-volt, 60-cycle single-phase motor. Over-all dimensions are 14 1/2 by 14 1/2 by 18 1/2 inches, and the weight is 95 pounds.

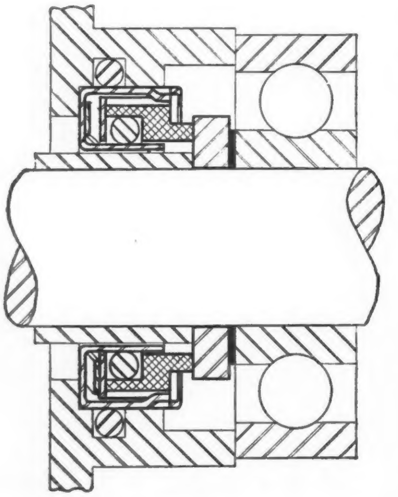


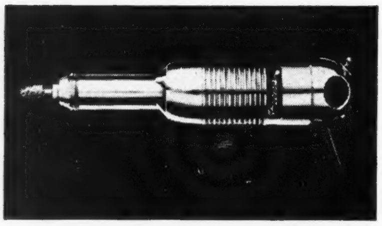
"Speedi-Spacer" for Locating Work for Drilling, Boring, and Milling

Multi-position locating device announced by the Queen City Machine Tool Co., 217 E. Second St., Cincinnati 2, Ohio. This spacer is designed for quick, accurate locating of parts for drilling, boring, or milling without jigs or fixtures. Positive positioning is provided by nine longitudinal and nine transverse positioning stop-screws. Hardened measuring pads on which these screws bear are an integral part of the unit. Longitudinal and transverse movements are determined by the various settings of the screws; table position is maintained by positive locks.

New Mechanical Shaft Seal

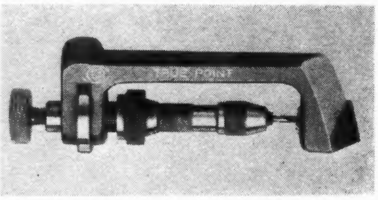
Positive mechanical shaft seal containing improvements developed to insure successful operation under the higher pressures, temperatures, and speeds now in use. Constructed of materials selected and tested to withstand exposure to practically all liquids and gases without deterioration. Product of Cartriseal Corporation, 1449 W. Randolph St., Chicago 7, Ill.





Precise "Super 40" Grinder-Miller

Multi-purpose, electrically powered grinder-miller announced by the Precise Products Co., 1328-30 Clark St., Racine 1, Wis. This tool is built for precision, high-speed applications when set up in "Precise" machine tool mounts on standard machine tools or when used as a portable hand-tool with or without the attachable "Coolflex" flexible shaft. Operates at speeds of 15,000 to 45,000 R.P.M. The 1/4-H.P. motor of the tool is said to adapt it for "round-the-clock" production grinding, milling, and finishing of small parts, as well as for all types of work in the tool-room.

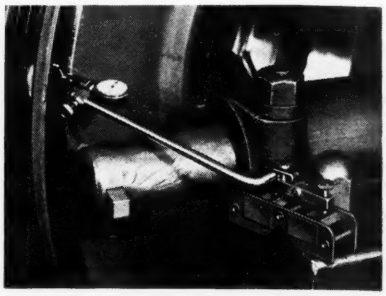


"True Point" Drill Sharpener

Drill point sharpener for use in sharpening right- and left-hand drills in sizes from No. 41 to 60 and 61 to 800. Designed to sharpen small drills so accurately that they become theoretically correct, with the drill point perfectly central and both cutting edges of equal length. Drills thus sharpened lead into the hole as though provided with a pilot, both lips cutting an equally balanced chip. The new device is used to sharpen the drills by hand, the material removed being too small for a grinding wheel. However, if drills are used in large quantities, they can be roughed out on a grinding wheel and then finished by the sharpener. The abrasive used is a carefully selected oilstone. Brought out by the Up-to-Date Tool Co., P. O. Box Station A, Department MY, Worcester 8, Mass.

Indicator Holder with Precision Adjustment

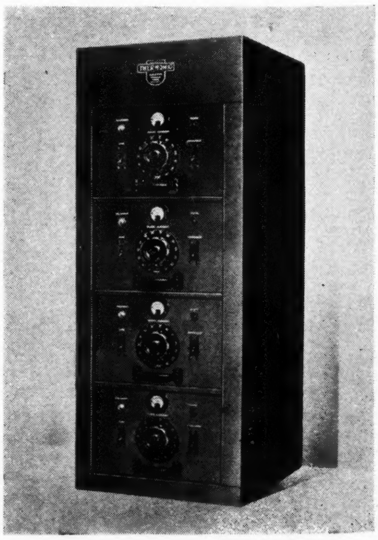
Magnetic dial-indicator holder with precision adjusting device for positioning the dial-holding rod. This device eliminates any possibility of the spring tension in the rod lifting the indicator off the work after the rod and indicator are positioned by hand. With this holder, the machinist can swing the holding rod and indicator to within 1/2 inch or so of the work. Then, by turning the thumb-screw on the magnetic base of the holder, he can make the most minute adjustment of the indicator, either against or away from the work.



The holder has a powerful 45- to 50-pound pull magnetic base, and will adhere positively to any metal that will hold a magnet. The holder rod is 6 1/2 inches long, and made of non-magnetic 1/4-inch stainless steel. It is set in a ball socket, permitting universal settings. Adapter bushings are available for use with indicators having 5/16- or 3/8-inch openings. Introduced by the Cullen Mfg. Co., Racine, Wis.

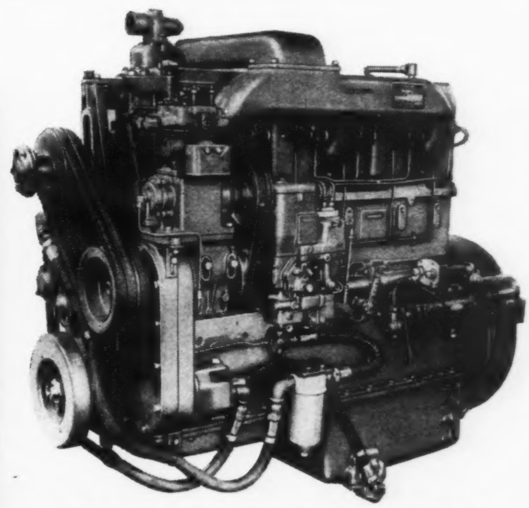
Multiple-Station Induction Heater

Multiple 2 1/2-kilowatt units, combined in a single cabinet for general-purpose induction heating applications. The individual units can be removed and replaced, similar to the drawer of a filing cabinet. These heating stations can be located at any place in the production line. Manufactured by the Induction Heating Corporation, 181 Wythe Ave., Brooklyn 11, N. Y., in different combinations to meet the user's particular requirements. The heating sections and power supply units may be arranged in one cabinet.

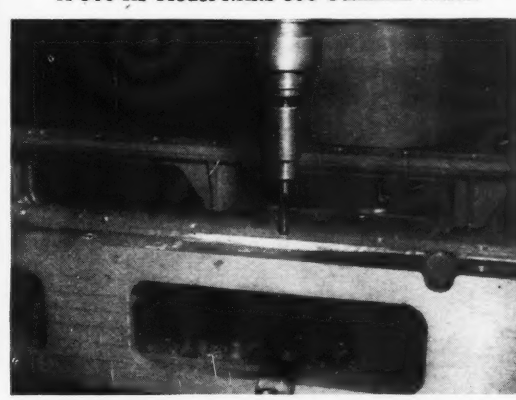


IT'S *super service* FOR THIS DIESEL...

Drilling oil pans for Cummins diesels—used in switching locomotives, power shovels and oil well drilling equipment and generator sets.



A 300 HP Model NHRS-600 Cummins diesel.



Photos courtesy of the Cummins Engine Co., Inc., Columbus, Ind.

Drilling operations on a Cummins diesel engine are shown here. The Cummins Engine Company indicates this Bickford Radial really meets their varied needs.

Many features contribute to the outstanding performance of Cincinnati Bickford Super Service Radial Drills.

The great range of speeds and feeds (36 speeds, 18 feeds) and step-saving controls centralized in the Super Service clear view head step up production.

Bickford hydraulic column clamps are standard, and the heavy arm, column, column trunk and base give great strength and rigidity.

Long life, low maintenance and accurate performance are all recognized features of Cincinnati Bickford Super Service Radial Drills.

Write for Bulletin R-29, on the 11" to 19" diameter column, and Bulletin R-22 on the 22" to 26" diameter column.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

Compound Joggles for Aircraft Work Easily Produced on Newly Developed Machine

A MACHINE devised to eliminate expensive tooling has been built and put into operation at Consolidated Vultee Aircraft Corporation's Fort Worth Division. This machine, known as a manual joggle machine, was manufactured for the aircraft industry by the Intercontinental Mfg. Co., Inc., at its plant in Garland, Tex.

The manual joggle machine, Fig. 1, is peculiarly suited to aircraft manufacturing because it can turn out compound joggles, or offsets, that are frequently encountered in aircraft production. It consists, mainly, of a stationary angle-plate, on which is mounted one set of jaw-holders, and a movable angle-plate, on which is mounted another set of jaw-holders.

The movable plate is actuated by a hand-lever through a unique directional selector device. The selector can be moved to any one of the four positions, depending upon the direction desired. The joggler embodies the stretch principle of operation, virtually eliminating springback in heat-treatable materials. It is said to produce joggles of uniform accuracy and excellent quality at a minimum cost.

The "Cerrotru" alloy jaws of the machine, which do the actual joggling, are cast in an inexpensively designed molding machine, which serves as an auxiliary unit. A section of the part to be offset, taken directly from the lot to be run, is clamped in position in the molding machine, and the molten alloy is poured around the part. After the casting has been water-cooled, it is removed from the molding machine.

Next the casting is cut into quarters on a band saw to form the jaws. The original section of material is then removed from the casting, and the four jaws are provided with a relief radius in the direction of the desired joggle. The jaws are now ready to be installed in the joggle machine. After setting them the proper distance apart to give the desired joggle length, they are locked in place. Change-over for joggling an entirely different type of section requires only thirty-four minutes, including casting of the jaws. Typical parts handled in this machine are shown in Fig. 2.

The machine described is now turning out production parts for the B-36 at the rate of three a minute.

* * *

Shipments of gear cutting and finishing machines in 1950 were valued at $19,800,000, an increase of 39 per cent over the previous year. Gear shapers, cutters, and generators represented almost half of the total value of shipments during 1950. All types of gear cutting and finishing machines showed increases in value over shipments in 1949.

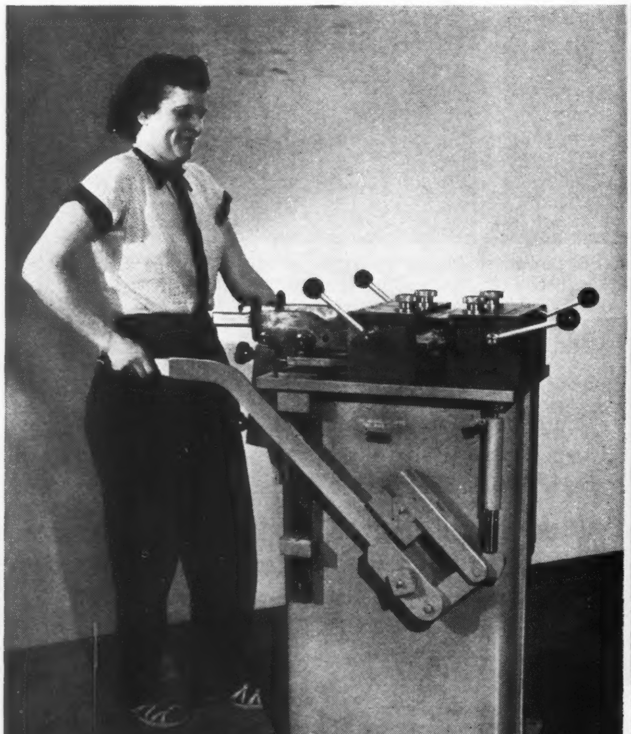


Fig. 1. Manual joggle machine is shown here with an aircraft part held between the jaws, ready for joggling, or offsetting

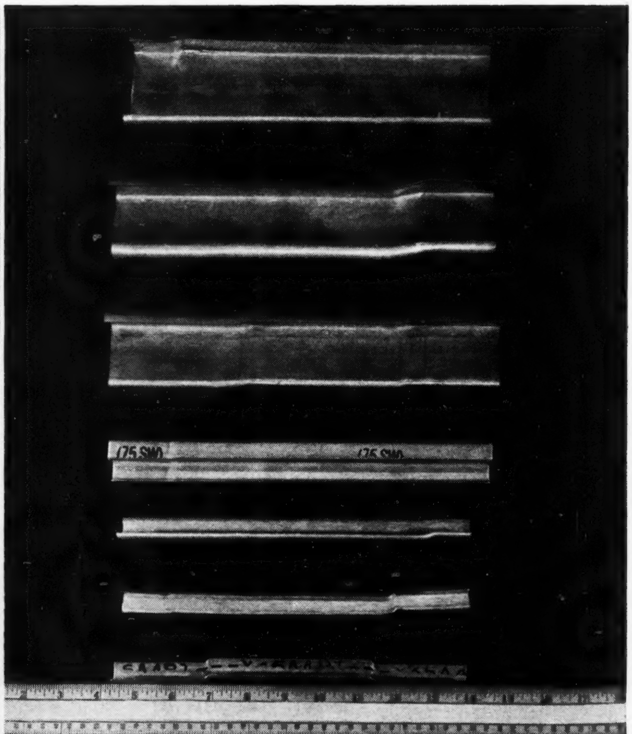
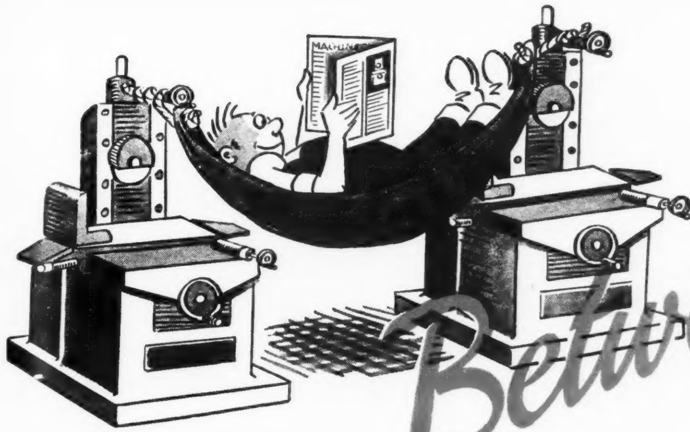


Fig. 2. Typical parts produced by the machine shown in Fig. 1. An example of a perfect compound joggle is seen at bottom



Between Grinds

By E. S. Salichs

We Cover the Corners

When the No. 2 micro speed turret lathe manufactured by the Simmons Machine Tool Corporation was described in MACHINERY, that concern, of course, received inquiries about it. In sequence, Inquiries 21, 22, and 23 caused a Simmons official to write us: "Evidently MACHINERY gets around, as we notice that these are inquiries from Japan, Israel, and Italy."

The Birth of Production Control

The introduction to an article in WE (Western Electric Co.'s house organ) which describes the "Iron Horse"—an automatic production control system for electrical coil manufacture in the company's Haverhill shop—reviews briefly the dawn of production control in this country. It began with a letter written in 1785 by Thomas Jefferson in Paris to John Jay: "An improvement is made here in the construction of muskets, which it may be interesting to Congress to know, should they at any time propose to procure any. It consists in making every part of them so exactly alike that what belongs to any one may be used for every other musket in the magazine."

Three years later, young Eli Whitney mailed this proposal to Washington: "I should like to undertake the manufacture of ten to fifteen thousand stand of arms. I am persuaded that machinery moved by water, adapted to this business, would greatly diminish the labor and greatly facilitate the manufacture of this article. Machines for rolling, forging, floating, boring, grinding, polishing, etc., may all be made use of to advantage."

The Government gave Eli the green lantern. It took him two years to tool up—but at last his system began to click and he delivered 10,000 "stand of arms"—which soothed his anxious financial backers, then as now.

Sweet Patrol

A candy manufacturer has installed a small size RCA metal detector on its manufacturing line to make sure that its candy is free from foreign metal particles. Should a nail head in the guise of a raisin be snuggling in a chocolate bon bon, such as you have cracked an incisor on at one time or other, a bell rings and the conveyor belt stops. Out plummets the plum.

Splash!

A chap who wrote applying for a clerical position in our organization, informed us: "While with the SEC, I was the only male stenographer in a pool of about a dozen girls."

Aerial Avoirdupois

Machines and machine parts supplanted cut flowers as the major item of air freight carried by United Air Lines during 1951. The list is based on total weight, and it stands to reason that a press crank, for instance, has the advantage over an orchid.

Specialty Sweet Leaks

A peculiar combination of names in a California plumbing concern resulted in the firm of Rainwater & Dessert.

FOR WHOM THE BELL TOILS—This photograph was the clever greeting card sent out by the News Bureau of General Electric Co. The huge Christmas bell is, in reality, a 30-foot steam turbine rotor under construction at the company's twenty-acre turbine plant, the "tinsel" being water used as a coolant in the manufacturing process

News OF THE INDUSTRY

Connecticut and Massachusetts

ARTHUR A. MERRY, chief tool engineer since 1940 of the Pratt & Whitney Aircraft Division, United Aircraft Corporation, East Hartford, Conn., has been made chief of advanced tool engineering—a newly created position—and EDWARD P. BULLARD III, has been named chief of production engineering. Another appointment is that of LEETE P. DOTY as superintendent of the North Haven branch plant, now nearing completion. He will be succeeded in his former position as superintendent of the Southington, Conn., plant by WILDOR G. EMOND.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., announces that it has acquired the common stock of the CONSOLIDATED MACHINE TOOL CORPORATION, Rochester, N. Y. The Consolidated plant will be operated as a subsidiary of the Farrel-Birmingham Co., and will continue the production of its regular machine tool lines. ARTHUR H. INGLE remains president of the Consolidated Corporation, and will become a director of the Farrel-Birmingham Co.

READY TOOL CO., Bridgeport, Conn., has appointed the following new representatives to handle the complete line of Red-E anti-friction centers and tools: HORACE S. WHITE, 4208 Applegate Ave., Cincinnati, Ohio; R. J. SEVERANCE, 210½ Washington St., Grand Haven, Mich.; E. S. WEIDLE, 715 Empire Bldg., Pittsburgh, Pa.; HARRY M. BEYERS, 4417 South Park Drive, Fort Wayne, Ind.

NELCO TOOL CO., Manchester, Conn., manufacturer of carbide-tipped metal-cutting tools, announces the completion of a new building program which more than doubles its manufacturing space. The company is celebrating its tenth anniversary this year.

J. RICHARD LEONARD was recently appointed sales representative in the Grinding Machine Division, Norton Co., Worcester, Mass., succeeding LOUIS J. CAMARRA, who has been assigned duties with Norton Behr-Manning Overseas Inc. Mr. Leonard's territory includes Maine, New Hampshire, Vermont, Rhode Island, and eastern and central Massachusetts, with headquarters at Worcester. Another announcement made by the Norton Co. was the retirement of H. WALTER WAGNER, head of the mechanical section of the research and development department.

C. JOHN SUNDBERG was recently appointed assistant to the vice-president in charge of sales for the Abrasive Division of the Norton Co., Worcester, Mass., and STEPHEN SMITH was named supervisor of the Worcester sales office, the position formerly held by Mr. Sundberg. Another appointment announced is that of FREDERICK J. BENN as field engineer in the Cleveland area. Mr. Benn was previously grinding engineer with the Worcester Sales Engineering Department.

Illinois

EVERETT D. GRAFF, chairman of the executive committee of Joseph T. Ryerson & Son, Inc., Chicago, Ill., retired from active service with the company on January 1, and has been succeeded by HAROLD B. RESSLER, first vice-president. Mr. Graff had been associated with the Ryerson organization for forty-five years, serving as president from 1937 through 1950. He will continue to act as a member of the board of directors and as a member of the board of the Inland Steel Co. Mr. Ressler is also a member of the Ryerson board, and has been elected a member of the board of directors of the Inland Steel Co. He has served in practically every capacity with the company during his forty-seven years of service.

Harold B. Ressler, new chairman of the executive committee of Joseph T. Ryerson & Son, Inc.

HAROLD GOLDSTEIN, for the last eighteen years associated with Machinery & Electric Motors Co., Chicago, Ill., has resigned to form his own firm—the AJAX MACHINERY CO., 809 W. Lake St., Chicago, Ill.—which will handle tool-room and production machinery and metal-fabricating equipment.

W. W. KOVALICK has been advanced from the position of chief engineer to production manager of the Chicago plant of the Ingersoll Products Division, Borg-Warner Corporation, succeeding J. W. DEAN, who has resigned. H. T. BURKE, previously chief tool engineer, becomes acting chief engineer.

JAMES H. INGERSOLL, vice-president of the Ingersoll Products Division, Borg-Warner Corporation, Chicago, Ill., has been placed in charge of all contract and defense sales. A. J. ROBERTSON has been made manager of defense sales, and L. R. MILLER manager of contract sales.

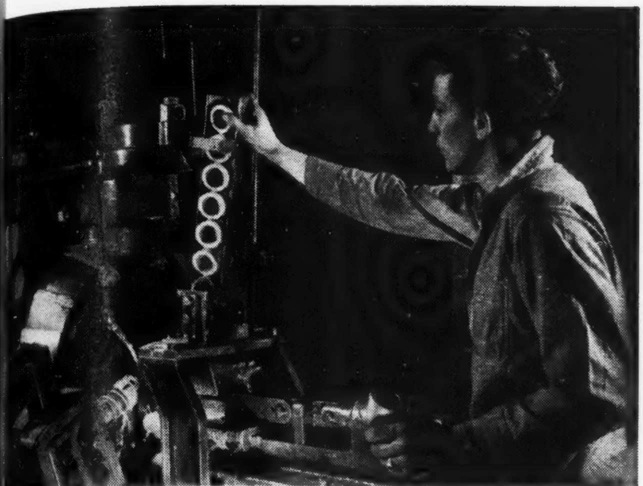
NELSON W. DEMPSEY, general superintendent of the Cuyahoga Works, Cleveland, Ohio, of the American Steel & Wire Co., has been appointed assistant manager of operations of the Chicago, Ill., district of the company, a division of the U. S. Steel Co.

DR. DANIEL P. BARNARD IV, research coordinator of the Standard Oil Co. (Indiana), Chicago, Ill., has been elected president of the Society of Automotive Engineers for 1952. He succeeds DALE ROEDDER of the Ford Motor Co.

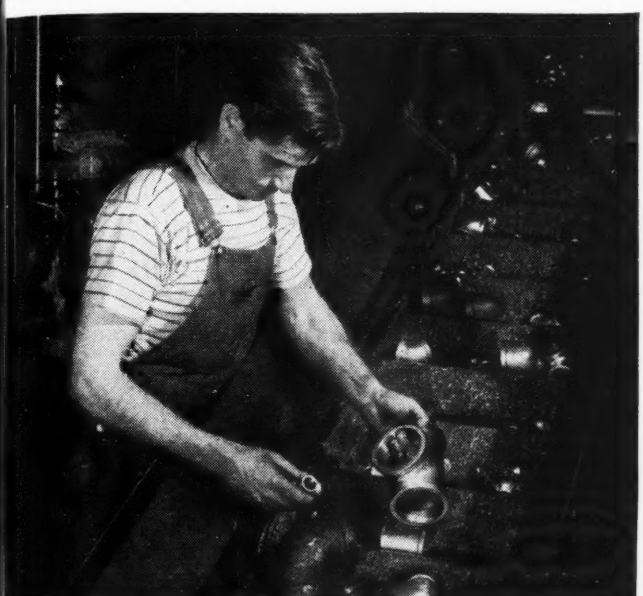
R. E. BIGELOW has been appointed manager of defense contracts, specializing in rotary and electronic products, for Portable Electric Tools, Inc., Chicago, Ill. He was formerly assistant sales manager.

J. DUDLEY LOCKREM, vice-president in charge of public and industrial relations of Scully-Jones & Co., Chicago, Ill., has been named sales manager, succeeding WILLIAM L. VOSS, JR., who is on leave of absence.

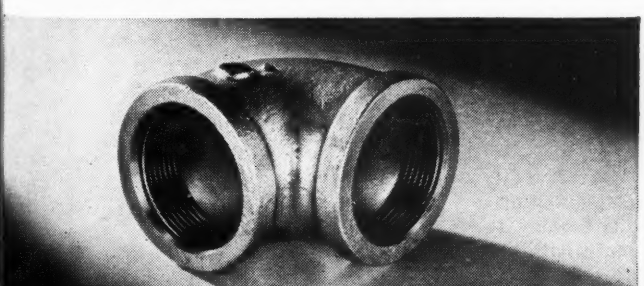
ACCURATE BUSHING CO., Garwood, N. J., manufacturers of drill jig bushings, announces the establishment of a Chicago office at 5722 W. Chicago Ave.



A PIPE FITTING MANUFACTURER had trouble with a straight cutting oil. It made the floors slippery; was suspected of causing skin irritations; discolored the fittings. In addition, a special cleaner and rust preventive had to be used.



CHANGING TO S.E.C.O. brought excellent results. This "Job Proved" emulsifying cutting oil kept the fittings from discoloring, minimized complaints about skin troubles, made floors safe, eliminated the need for a special cleaner and rust preventive.



OPERATIONAL DATA. Machine: 2" automatic tapping machine • Metal: Malleable iron • Operation: Thread and chamfer 1½" 45° elbow • Cutting Speed: 75 SFM • Tools: High speed • Production: 306 pieces per hour • Cycle Time: 11¾ sec.

S.E.C.O. REPLACES THREE PRODUCTS; REDUCES COSTS, MAKES SHOP CLEANER, SAFER

Ten years ago, one of the largest manufacturers of pipe fittings was using a straight cutting oil that proved to be a production headache. It made floors slippery, discolored the fittings, even was blamed by the operators for causing skin ailments.

The company overcame these problems—with extra benefits for good measure—by changing to Sunoco Emulsifying Cutting Oil. S.E.C.O. performed as a quality cutting oil is expected to, and eliminated the need for two costly supplementary products: a special alkali cleaner and a rust preventive. Sprayed on the parts conveyed through the washers, S.E.C.O. left a film that gave complete protection against rusting. Oil costs were reduced to an amazing extent; floors were safe; complaints about skin irritations were minimized and shop morale improved. The pipe fittings, free of discoloration, commanded a better position saleswise. The company standardized on S.E.C.O. and has been using it ever since.

In all machine shop operations, on both ferrous and nonferrous metals, Sun Emulsifying Cutting Oil is definitely superior. That's why more S.E.C.O. is used than all other brands of emulsifying cutting oil combined. For more operational data on typical S.E.C.O. applications, write for a copy of the new "Cutting and Grinding Facts." Department **M-1.**

SUN INDUSTRIAL PRODUCTS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SUNOCO ®

R. E. Waldo, recently appointed general manager of New Departure Division of General Motors Corporation

Michigan and Wisconsin

R. E. Waldo, assistant general manager of the New Departure Division, General Motors Corporation, Detroit, Mich., has been promoted to the position of general manager of the division. He succeeds Milton L. Gearing, who is leaving to enter business for himself. Mr. Waldo has been affiliated with the corporation for twenty-five years, serving in various capacities.

Howard L. McGregor, Jr., has been elected president of the National Twist Drill & Tool Co., Rochester, Mich., succeeding his father, who has become chairman of the board.

Photo Deigh Navin

Howard L. McGregor, Jr., newly elected president of National Twist Drill & Tool Co.

Dow Chemical Co., Midland, Mich., announces the formation of two new wholly owned subsidiaries known as Dow Chemical Inter-American, Ltd., and Dow Chemical International, Ltd. The former company will handle the business affairs of the parent company in Mexico, Central and South America, and the West Indies, while the latter will perform similar functions in Europe, Asia, Africa, and Australia. These companies will take over the functions of the present export sales department. Clayton S. Shoemaker, formerly eastern sales manager, will head the new organizations as president. The headquarters will be in Midland, Mich.

Dr. William Hirschkind, for many years research director of the Western Division of the Dow Chemical Co., Midland, Mich., has been appointed technical adviser to the president, Leland I. Doan. Robert G. Heitz, who was Dr. Hirschkind's assistant, has been promoted to the position vacated by Dr. Hirschkind. Other appointments are George J. Zahringer, Jr., as assistant in the developmental sale of solvents for industrial applications; and Fred A. Koch of the New York office as special assistant to Donald K. Ballman, general sales manager.

R. G. Wingerter has been appointed assistant general manager of the Timken Roller Bearing Co., Canton, Ohio, and J. R. Splitstone has been made district manager of the Automotive Sales Division. Both men will continue to make their headquarters at the company's general Automotive Sales Division office, 3107 W. Grand Blvd., Detroit 2, Mich.

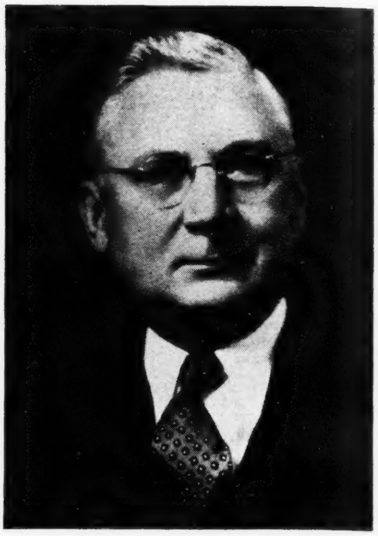
Cecil M. Peter has joined the Detroit Division of Amgears, Inc., in the capacity of vice-president. Prior to his new connection, Mr. Peter had been connected with the Fellows Gear Shaper Co., Springfield, Vt., in the capacity of vice-president and general manager.

J. T. Bell has been promoted to the position of Detroit district manager for the Mid-West Abrasive Co., Owosso, Mich. For the last seven years he has been a sales representative for the company.

Detroit Tap & Tool Co., Detroit, Mich., has recently completed a 26,000 square foot addition to its factory at Cheboygan, Mich. The main building is 260 feet long by 100 feet deep.

Robert A. Weisse has been appointed assistant sales manager of the Kaydon Engineering Corporation, Muskegon, Mich., manufacturer of ball and roller precision bearings.

John H. Nebel, Milwaukee district sales manager for the Gisholt Machine Co., Madison, Wis., has retired after fifty-one years of continuous service with the company. He started with the company in 1899 and in 1920 was placed in charge of the Milwaukee territory.

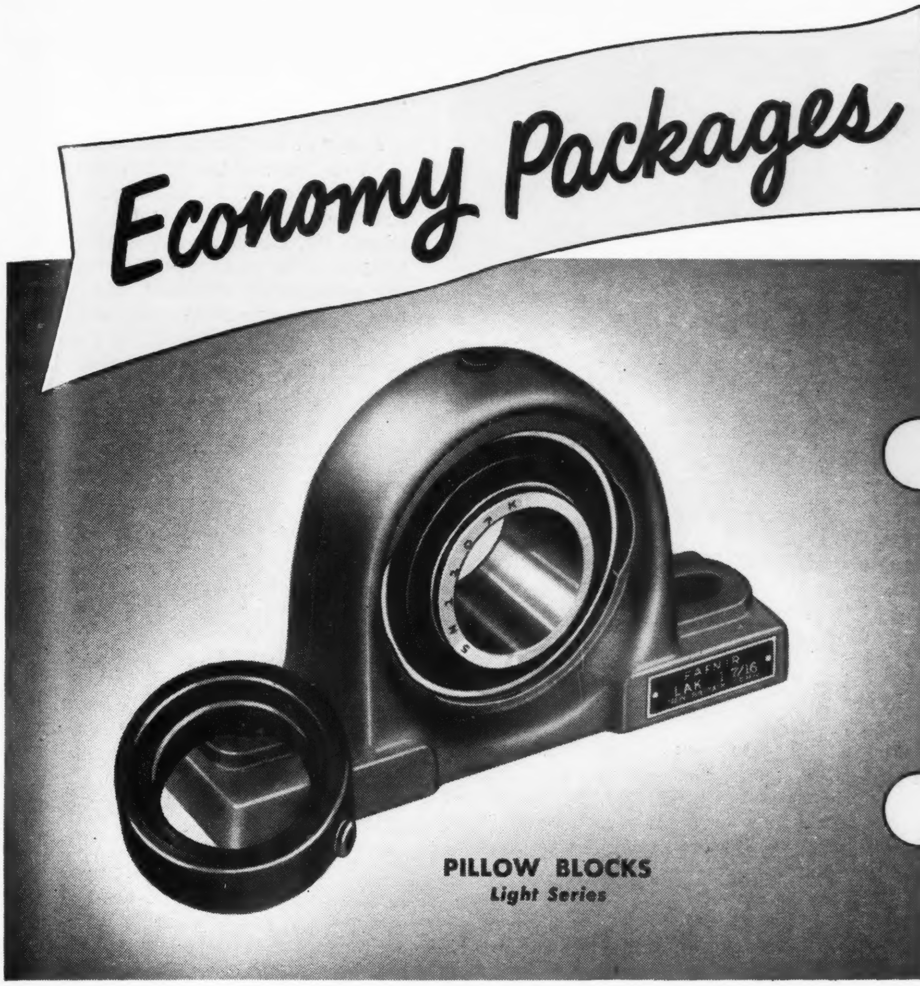


John H. Nebel, Milwaukee representative for Gisholt Machine Co., who is retiring after fifty-one years of continuous service with the company

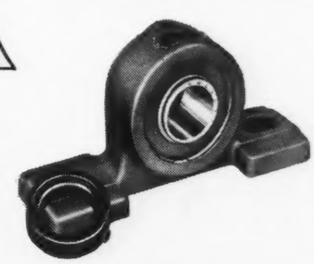
New York and New Jersey

Alfred J. Fava has been named sales director of the General Products Division of the American Machine & Foundry Co., New York City. Mr. Fava was formerly sales manager of the Lowerator Division, now a department of the General Products Division. He will be succeeded in that position by J. J. Cranmore. The Chicago area sales office of the Lowerator

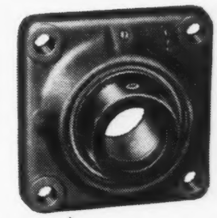
Alfred J. Fava, new sales director of the General Products Division, American Machine & Foundry Co.



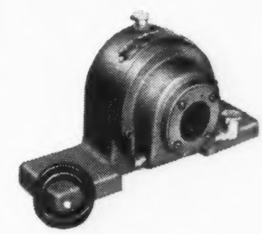
Typical Fafnir "packaged" ball bearing units.



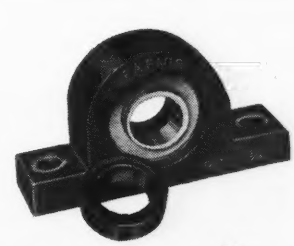
PILLOW BLOCKS
Medium and Heavy Series



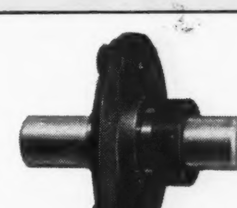
CARTRIDGES
Light and Heavy Series



PILLOW BLOCKS
Fixed and Floating Types



RUBBER UNITS



FLANGETTE

If you make machinery or equipment you know the magic selling power of a tag on your product saying "Ball Bearing Equipped". ↑ ↑ ↑ Much as you would like to add the selling plus of ball bearings to your own product it is not always a simple matter to change over from less efficient bearings. ↑ ↑ ↑ Fafnir has gone a long way to help you gain these advantages by "packaging" ball bearings in complete units, including housings, seals and shields, in shapes and sizes to fit an amazing variety of machines and equipment and to function properly under all types of operating conditions. ↑ ↑ ↑ A few minutes spent with a Fafnir engineer may bring forth an Economy Package which gives you all the advantages of ball bearings at minimum cost. The Fafnir Bearing Company, New Britain, Conn.

FAFNIR
BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

Photo Delar

F. J. Koegler, newly elected president of Doehler-Jarvis Corporation

Adolf J. DeMatteo, recently appointed chief engineer of the Watson-Stillman Co.

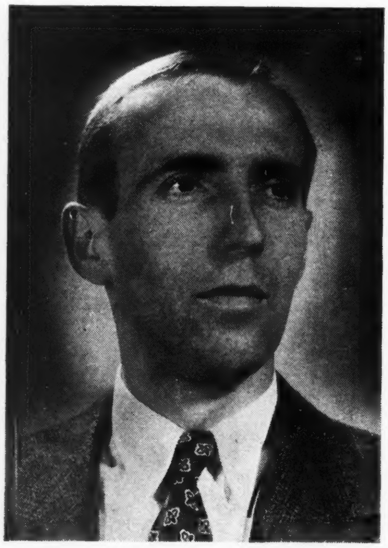
Department, formerly headed by Mr. Cranmore, is being taken over by J. B. MOLONEY.

H. H. DOEHLER, chairman of the board of directors of the Doehler-Jarvis Corporation, New York City, has resigned, but has accepted the office of honorary chairman of the board. L. A. JARVIS, formerly president of the corporation, has been promoted to chairman of the board, while F. J. KOEGLER, executive vice-president, has become president.

THEODORE M. DILLAWAY and GEORGE B. KELLOGG have been elected assistant vice-presidents of the Buffalo Forge Co., Buffalo, N. Y., manufacturer of punching, shearing, bending, and drilling machines, forges, industrial fans, centrifugal pumps, etc. Both men started working for the company in 1940; Mr. Dillaway was formerly assistant secretary, and Mr. Kellogg was assistant production manager.

FRED P. BIGGS has been elected a vice-president of the American Brake Shoe Co., New York City. Mr. Biggs is also president of the company's Brake Shoe and Castings Division.

J. W. HAINES, technical service representative of Oakite Products, Inc., New York City, manufacturer of industrial cleaning materials, recently received the D. C. Ball Award for Distinguished Service. This award will be presented annually to the member of the firm's field organization who is adjudged to have rendered the most outstanding service to industry during the year.



(Left) Theodore M. Dillaway and (Right) George B. Kellogg, newly elected assistant vice-presidents of Buffalo Forge Co.

ADOLF J. DEMATTEO has been made chief engineer of the Watson-Stillman Co., Roselle, N. J., manufacturer of hydraulic machines, tools, and fittings. Mr. DeMatteo joined the company in 1944, and since 1946 has held the position of assistant chief engineer. Announcement has also been made of the appointment of JACKSON KEMPER as general manager of sales of the Distributor Products Division.

Ohio

WARNER & SWASEY Co., Cleveland, Ohio, builder of machine tools and precision instruments, is planning to construct a $1,500,000 plant in New Philadelphia, Ohio, for the manufacture of machine tool parts. The building will be located adjacent to the company's present Gradall plant. It will be of one-story construction, with 110,000 square feet of manufacturing space. The plant is expected to be completed and operating by next June.

ELMER I. FABER has been appointed plant superintendent and head of the engineering department of the Conforming Matrix Corporation, Toledo, Ohio, manufacturer of spray painting shields, tools and fixtures, and other spray painting equipment. MILTON T. SCHIMMEL has been made engineering sales manager.

ARTHUR W. HASENPFLUG, formerly works manager of the Artisan Metal Works Co., Cleveland, Ohio, and for the last year general manager of the company, has been appointed vice-president. FRED A. MONTGOMERY has been made chief engineer.

GEORGE K. LANE has been made district representative in the Cleveland and Pittsburgh territories for Ipsen Industries, Inc., Rockford, Ill., manufacturers of automatic heat-treating equipment. His headquarters are at 15017 Detroit Ave., Lakewood, Ohio.

T. F. FLEMING has recently been made general manager of the Morrison Engineering Co., Cleveland, Ohio, manufacturer of heat-treating and annealing furnaces, forging furnaces, and hardening ovens.

HOMER E. BENHOFF has been appointed field secretary for the National Tool & Die Manufacturers Association, with headquarters in Cleveland, Ohio.

ABRASIVE GRAIN ASSOCIATION announces the removal of its headquarters from 27 Elm St., Worcester, Mass., to 2130 Keith Bldg., Cleveland 15, Ohio.

Howard U. Herrick, newly appointed president of the E. W. Bliss Co.

HOWARD U. HERRICK, executive vice-president of the E. W. Bliss Co., Canton, Ohio, from 1934 to 1944, has been appointed president. Mr. Herrick retired from the company in 1944, but at the request of the board of directors is now returning to active management. The new president succeeds LOUIS C. EDGAR, JR., who resigned on November 12.

AMERICAN WELDING & MFG. CO., Warren, Ohio, announces that it has made an agreement with the WARREN MACHINE & DIE CO. whereby the latter company becomes the WARREN MACHINE & DIE DIVISION of the American Welding & Mfg. Co.

MAYNARD W. MCMILLAN has been appointed representative in the southwestern Ohio territory for the line of industrial trucks made by the Baker-Raulang Co., Cleveland, Ohio. His headquarters are at 2820 Jessup Road, Cincinnati, Ohio.

THOMAS J. MOORE, JR., vice-president of the Brainard Steel Division of the Sharon Steel Corporation, Warren, Ohio, has been promoted to the position of general manager of the Division.

GRINDING WHEEL INSTITUTE announces the removal of its headquarters from Greendale, Mass., to 2130 Keith Bldg., Cleveland 15, Ohio.

Oregon, California, and Washington

HANNA ENGINEERING WORKS, Chicago, Ill., has appointed the Power Transmission Products Division of the Portland Iron Works, 1107 N. W. 14th Ave., Portland 9, Ore., distributor for Hanna pneumatic and hydraulic cylinders and valves.

CARL HIRSCHMANN CO., Manhasset, N. Y., announces the opening of a western branch at 5124 Pacific Blvd., Los Angeles, Calif., where a large selection of high-precision Swiss machine tools will be on display.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., steel distributors, have acquired the stocks and warehouse facilities of the SEATTLE STEEL CO., Seattle, Wash., and the INLAND EMPIRE STEEL CO., Seattle and Spokane, Wash.

Pennsylvania

DR. FRANCIS C. FRARY has retired as director of research for the Aluminum Co. of America, Pittsburgh, Pa. Dr. Frary's retirement brings to an end the active career of one of the nation's distinguished chemists and metallurgists. He was the founder of organized research in the aluminum industry. Joining Alcoa in December, 1918, he organized the company's aluminum research laboratory at New Kensington, Pa., which became one of the world's foremost industrial metallurgical research institutes. Dr. Frary holds more than thirty United States patents, and is author and co-author of numerous books and papers dealing with metallurgical and chemical subjects. DR. KENT R. VAN HORN, formerly associate research director, succeeds DR. FRARY as director of research.

HARVEY T. HARRISON, vice-president of the Duraloy Co., Scotdale, Pa., has been elected president of the Alloy Casting Institute, national technical organization of heat- and corrosion-resistant casting producers. Mr. Harrison formerly served as vice-president of the Institute.

JAMES T. BARNARD has been made assistant manager of the Detroit branch of the Pittsburgh Crucible Division, Crucible Steel Co. of America, Pittsburgh, Pa. Also announced is the appointment of HARRY I. ASKEW, JR., as salesman in the Chicago branch of the company.

L. J. CARSON, formerly general manager of the Minneapolis plant of the Link-Belt Co., has been named general manager of the company's new Colmar, Pa., plant. This plant is now under construction, and is scheduled to be in operation during the last quarter of the year.

P. J. SLAVISH has been placed in charge of testing equipment sales in the Pittsburgh area for the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Prior to his present appointment, Mr. Slavish was manager of the Pittsburgh office.

J. DONALD ROLLINS has been appointed assistant vice-president, engineering, by the U. S. Steel Co., Pittsburgh, Pa. He was previously project manager of the Fairless Works of the company in Morrisville, Pa.

PHILIP DOLLIN has been appointed representative for the Dollin Corporation, Irvington, N. J., die-castings manufacturer, in eastern Pennsylvania, Maryland, and Delaware. Mr. Dollin is located at 209 Rosemary Lane, Germantown, Pa.

Texas, Louisiana, and Georgia

VERNON N. FERGUSON, assistant chief industrial engineer for the Texas Division of North American Aviation, Inc., during World War II, and more recently on the faculties of the University of Kansas and the University of Texas, has been appointed chief industrial engineer of the Texas Engineering & Mfg. Co., Inc., Dallas, Tex.

JOHN LUND has been appointed district manager of the Air Reduction Magnolia Co., a division of Air Reduction Co., Inc., New York City, with headquarters at Shreveport, La. He is assuming the responsibilities of the late Heber T. Wadley. Mr. Lund formerly occupied the position of assistant manager of the Air Reduction Magnolia Co.

LEEDS & NORTHRUP CO., Philadelphia, Pa., manufacturer of electrical measuring instruments, automatic controls, and heat-treating furnaces, has opened a sales and service office at 3084 Grandview Ave., Atlanta 5, Ga. The manager of the new office is WILLIAM A. MACAN, III.

Mexico and France

NORTON BEHR-MANNING OVERSEAS, INC., has formed a new sales distributing company in Mexico City, Mexico, known as NORTON BEHR-MANNING, S.A. de C.V., which will supervise the sales and distribution of the products of the NORTON CO., the BEHR-MANNING CORPORATION, and the NORTON PIPE CO., throughout Mexico. Dealer organizations in Mexico will remain unchanged. The president of the new sales company is HERBERT A. STANTON, and the vice-president and general manager is EDGAR A. MASCHAL, who was formerly with the Durex Abrasives Corporation.

MARSHALL M. SMITH has been appointed managing director of the Paris office of Emhart Mfg. Co., and in this capacity will be in charge of European and North African business for all the company's operating units, including the Henry & Wright Division, Hartford, Conn., and the V & O Press Co., Hudson, N. Y. Mr. Smith recently held the post of director of the Machinery Division of

the National Production Authority, but prior to this appointment was president of the E. W. Bliss Co., Canton, Ohio. His address will be Care of Arthur Andersen, Turquand, Youngs & Co., 11 Rue le Grand, Paris, France.

Coming Events

February 9-March 24 — International Industrial Machinery Exposition in Delhi, India. Further information can be obtained from Consulate General of India, 3 E. 64th St., New York 21, N. Y.

March 3-7—Spring meeting of the American Society for Testing Materials at the Hotel Statler, Cleveland, Ohio. Executive secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

March 11-14—Fifth National Plastics Exposition, sponsored by the Society of the Plastics Industry, Inc., to be held at Convention Hall, Philadelphia, Pa. Further information can be obtained from Langdon P. Williams, director of public relations, 67 W. 44th St., New York, N. Y.

March 17-21—Ninth Biennial Industrial Exposition of the American Society of Tool Engineers at the International Amphitheatre, Chicago, Ill. Harry E. Conrad, executive secretary, 10700 Puritan Ave., Detroit 21, Mich.

March 22-April 6—Second Chicago International Trade Fair at the Navy Pier, Chicago, Ill. For further information, write to Executive Vice-president John N. Gage, Colonel U. S. A. (Ret.), Merchandise Mart, Chicago 54, Ill.

April 1-4—Twenty-first annual conference on packaging, packing, and shipping and National Packaging Exposition at the Public Auditorium in Atlantic City, N. J. Further information can be obtained from the American Management Association, 330 W. 42nd St., New York City.

April 29-30—Eighth annual meeting of the Metal Powder Association and Metal Powder Show at the Drake Hotel, Chicago, Ill. Headquarters of the Association, 420 Lexington Ave., New York 17, N. Y.

May 1-7 — International Foundry Congress and Show at Convention Hall, Atlantic City, N. J. Sponsored by the American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill.

May 14-16—Spring meeting of the Society for Experimental Stress Analysis at the Hotel Lincoln, Indianapolis, Ind. For further information, address the Society at P. O. Box 168, Cambridge 39, Mass.

May 22-24 — Sixth annual convention of the American Society for Quality Control at the Onondaga County War Memorial, Syracuse, N. Y. Further information can be obtained from the Society, Room 5036, 70 E. 45th St., New York 17.

June 23-27 — Fiftieth anniversary meeting of the American Society for Testing Materials at the Hotels Statler and New Yorker in New York City. Further information can be obtained from the executive secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

September 8-10 — Third National Standardization Conference sponsored by the American Standards Association in Chicago, Ill. Headquarters, Museum of Science and Industry. Further information can be obtained from the Association, 70 E. 45th St., New York 17, N. Y.

November 19—Thirty-fourth annual meeting of the American Standards Association at the Waldorf-Astoria in New York. Headquarters of Association, 70 E. 45th St., New York City.

New Books and Publications

Marks' Mechanical Engineers' Handbook. Edited by Lionel S. Marks. 2236 pages, 6 by 9 inches; over 2000 illustrations and charts. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $15.

More than one hundred authorities have collaborated in the production of the completely revised new fifth edition of a handbook covering every branch of mechanical engineering, including the latest available information in such fields as aeronautics, mechanical refrigeration, power generation, welding, metal-cutting machines, hoisting and conveying, atomic power, etc.

The book is divided into sixteen sections dealing with the following subjects: Mathematical Tables and Weights and Measures; Mathematics; Mechanics of Solids and Liquids; Heat; Strength of Materials; Materials of Engineering; Fuels and Furnaces; Machine Elements; Power Generation; Hoisting and Conveying; Transportation; Building Construction and Equipment; Machine Shop Practice; Pumps and Compressors; Electric Engineering; and Engineering Measurements, Mechanical Refrigeration, etc.

Among the recent developments discussed are fluid mechanics, stresses in turbine discs, transonic and supersonic aerodynamics, aircraft jet propulsion, rockets, and television. Information is also given on such new processes as radiant or panel heating, solar heating, high-vacuum pumps, industrial supersonics, modern casting methods, statistical quality control, and automatic process control. The "Materials of Engineering" section includes new or revised data on ferrous and non-ferrous alloys, superalloys for highest temperatures, plastics, rocket fuels, powder metallurgy, and other developments in the field of materials.

A completely cross-referenced index of more than 12,000 items and a new and large format thumb-index make it easy for the user to locate the desired information.

The Grinding Wheel. By Kenneth B. Lewis. 409 pages, 6 by 9 inches. Published by the Grinding Wheel Institute, 2130 Keith Bldg., Cleveland 15, Ohio. Price, $3.50.

This text-book on grinding practice was sponsored by the Grinding Wheel Institute in order to foster a better understanding of the uses and applications of the modern grinding wheel. The book is intended to serve as a reference source, and incorporates manuals of instruction issued by makers of abrasives and of grinding machines.

The text is divided into twenty-eight chapters discussing the following specific subjects: Grinding; The Abrasive Materials; Making The Wheel; Wheel Shapes and Sizes; Fundamentals of Grinding; Grinding Fluids; Rough Grinding; Evaluation of Surface Quality; Cylindrical Grinding; Centerless Grinding; Surface Grinding; Truing, Dressing, and Balancing; Crush-Forming; Internal Grinding; Tool and Cutter Sharpening; Grinding Cemented Carbides; Disc Grinding; Cutting off; Thread Grinding; Gear Grinding; Crank and Cam Grinding; Roll Grinding; Honing, Lapping, and Superfinishing; Factors Affecting Wheel Selection; Design for Grinding; Grinding Non-Metallics; Further Applications; and Costs.

An appendix covers Grinding Wheel Recommendations; Causes and Corrections of Common Grinding Errors; Grinding Wheel Safety; Safe Operating Speeds; American Standard Grinding Wheel Markings; Glossary of Grinding Terms; and Publications of the Grinding Wheel Institute.

(This column continued on page 259)

FBI Register of British Manufacturers (1951-1952). 882 pages; 7 1/2 by 9 1/2 inches. Published for the Federation of British Industries by Kelly's Directories, Ltd., & Iliffe & Sons, Ltd., Dorset House, Stamford St., London, SE 1, England. Price, 42 shillings.

This is the only authorized directory of the Federation of British Industries, the largest and most influential association of British manufactures. The volume, designed to promote Britain's export trade, provides a substantial cross-section of the most important producers of British goods over a wide range of industry.

The Register comprises seven sections, including a classified buyers' guide listing over 6000 member firms under more than 5000 industrial headings, arranged alphabetically; a section constituting an illustrated catalogue of British products; an alphabetical list of all member firms, with full addresses, telegraphic addresses, telephone numbers, products, and in many cases, home and overseas branches, agencies, etc.; classified information on all trade associations affiliated with the FBI; a list of trade names and brands of products, together with the names of the makers; a section reproducing the registered trademarks of different products and giving the names of manufacturers; and a supplementary section containing details of newly elected members. The general information is given in English, French, and Spanish.

Work Measurement Manual. (Fourth edition). By Ralph M. Barnes. 304 pages, 8 1/2 by 11 inches. Published by the William C. Brown Co., 914 Main St., Dubuque, Iowa. Price, $4.75.

The importance of time study; the procedure commonly used in making time studies; and work measurement investigations now being conducted by the author, together with preliminary findings, are explained briefly in this manual. It tells how to conduct a community time-study survey, and gives the results of several such surveys. In addition, it describes how an organization can proceed to check the ability of its time-study men to set time standards, as well as to improve the accuracy and consistency of such standards, and explains how normal performance rating factors are determined.

A section is included on the use of standard motion-time data for operations on such machines as punch presses, hand screw machines turret lathes, sensitive drills, and hand tappers. The final section of the book gives a report of a comprehensive industrial engineering survey made by Dr. Barnes covering companies employing from 50 to 15,000 people.

Obituaries

E. C. Filstrup

E. C. Filstrup, for thirty-five years president of the Covel Mfg. Co., Benton Harbor, Mich., died on November 16 of a heart attack while hunting deer in northern Michigan. He was sixty-five years of age. Mr. Filstrup had spent all his active business career with the Covel Mfg. Co. In addition to his industrial activities, he was well known as a big game hunter, having spent nine months in East Africa on a hunting expedition.

Clary Allen

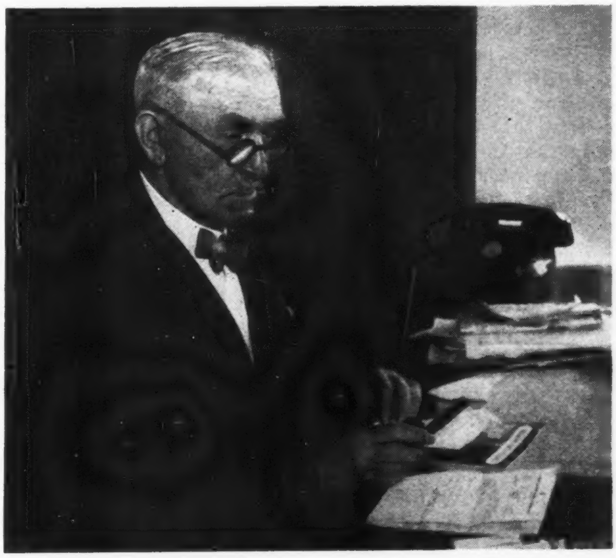
Clarence Edgar Allen, retired editor of the British publication Machinery, died on December 24, in New Romney, Kent, England, at the age of eighty years. Mr. Allen was editor of that magazine from its inception in 1912 until his retirement on March 31, 1951. At an early age he became interested in technical journalism, and prior to his association with Machinery was editor of two other technical publications. Mr. Allen had been an associate member of the Institution of Mechancal Engineers and the Institution of Electrical Engineers.

James A. Rafferty

James A. Rafferty, vice-president and director of the Union Carbide and Carbon Corporation, New York City, died at Fort Lauderdale, Florida, on December 19 at the age of sixty-five. Mr. Rafferty was a pioneer in the development of the synthetic organic chemical industry in the United States, which had been built up largely under his direction since its beginning in 1920. During World War II, he was executive officer in charge of the extensive operations of Union Carbide in behalf of the Government's wartime synthetic rubber and atomic energy programs.

Mr. Rafferty joined the Linde Air Products Co.—a unit of the Union Carbide and Carbon Corporation—in 1917, and rapidly rose to the position of works manager. In 1920, he became general manager of the newly formed Carbide and Carbon Chemicals Corporation. His success in this connection led to his election as a vice-president of the corporation in 1924. In 1929, he was made president of Carbide and Carbon Chemicals Corporation, and in 1939, was elected president of the Bakelite Corporation. Later he became chairman of the board of both these corporations. During his long career, he held many other positions of responsibility with the corporation and its various subsidiaries.

(Obituaries continued on page 260)



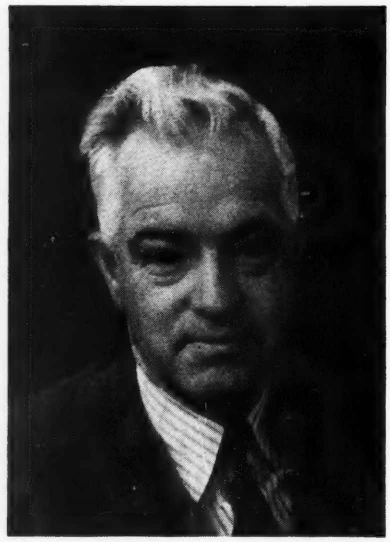
Clarence Edgar Allen

H. L. Van Keuren

H. L. Van Keuren, founder and president of the Van Keuren Co., Watertown, Mass., died in Honesdale, Pa., on January 6 at the age of sixty-three years. Mr. Van Keuren was born in Honesdale, Pa., in 1889. He graduated from Pennsylvania State College in 1911 as an electrical engineer, and three years later was appointed to the staff of the Bureau of Standards, Washington, D. C., where, at the close of World War I, he was in charge of the Gage Section. During this period, he organized the work of inspecting, manufacturing, and salvaging gages for the Bureau. The work done at the Bureau during that time was instrumental in establishing the basis of the high standards of gaging practice now existing in this country.

While in Washington, Mr. Van Keuren also served as executive secretary for the National Screw Thread Commission, a body appointed by Congress to standardize screw threads in the United States, and prepared the first report of this Commission. Most of this report is now incorporated in "Screw Standards for Federal Services, 1939." While at the Bureau, he directed the first experimental work in the development of gage-blocks in the United States.

After the war, Mr. Van Keuren was employed as gage engineer by the Wilton Tool Co., of Boston, Mass. In March, 1920, he organized the Van Keuren Co. to engage in the manufacture of precision measuring tools. Today, the company's products include gage-blocks, optical flats, the light-wave micrometer (invented by Mr. Van Keuren), cylindrical plug gages, thread measuring wires, and gear measuring wires. The Van Keuren system for accurate checking of gears with wires was devised, and the first tables worked out, in 1934. Most of Mr. Van Keuren's activities in recent years were devoted to problems of gear measurement.



Lewis A. Hastings

Lewis A. Hastings, advertising manager of the Heald Machine Co., Worcester, Mass., died on December 21 at the age of sixty-four years. He was the oldest Heald employe in point of service, having been associated with the company for forty-three years, thirty-seven of which had been spent in the advertising department.

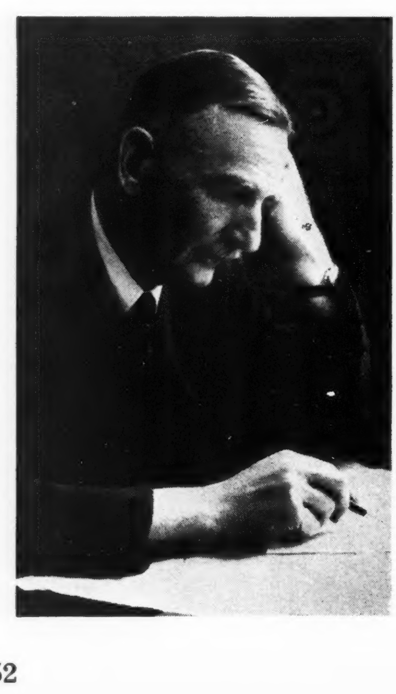
Mr. Hastings was a member of the Technical Advertisers Association, National Industrial Advertising Association, American Society of Tool Engineers, Worcester Mechanics Association, and Advertising Club of Worcester, of which latter society he had been a past-president. He is survived by his wife.

Dr. Fernand Turrettini

Dr. Fernand Turrettini, creator of the well-known Sip jig borers, died after a brief illness in Geneva, Switzerland, on November 3. At the time of his death, he was the active head of Societe Genevoise d'Instruments de Physique.

Dr. Turrettini was born in 1882 in Geneva, and graduated from the Ecole Polytechnique Federale in Zurich. He completed his studies in Germany and France, and worked for some time at the International Office for Weights and Measures at Sevres in Paris.

In 1907, he joined the Societe Genevoise d'Instruments de Physique, of which his father was managing director, and in 1924, took over the management of the concern. Dr. Turrettini orginated the jig borer and was responsible for its development up to the latest Hydroptic model. In 1950, Dr. Turrettini and his associates established the American Sip Corporation as a United States subsidiary. He was an active director of the new organization until his death.



Leonard A. Yoder, a partner of Jones & Yoder, New York City machinery distributors and local representatives of the Yoder Co., died in Stamford, Conn., on January 1 at the age of fifty-five years, after a short illness. From 1935 to 1945, Mr. Yoder was associated with the Yoder Co., Cleveland, Ohio, first in the engineering department and then in the sales department. During World War II, he served as superintendent of the Shell Division of the company.

Richard A. Metcalf, sales manager of the Miller Electric Mfg. Co., Appleton, Wis., died on December 20 after a heart attack which occurred while he was shoveling snow at his home. His age was forty-two years. Mr. Metcalf was appointed sales manager last October after an experience of fourteen years in the welding industry.

* * *

Service Recognition Plan for Ryerson Employes

A service recognition plan for employes has been set up by Joseph T. Ryerson & Son, Inc., Chicago, Ill., steel distributors, whereby employes with twenty-five years and longer continuous service will become members of the Ryerson Quarter Century Club, and will be presented with gold pins. At the present time, approximately 290 employes are eligible for membership in the club.

* * *

So exacting is the process of making sintered carbides that some companies even examine the employes' fingernails to insure that no foreign matter will contaminate the carbide in the "mix."